



SF/AR  
6.9.2.1

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
**REGION 10**  
1200 Sixth Avenue  
Seattle, Washington 98101

April 28, 1998

Reply To  
Attn Of: ECL-113

**MEMORANDUM**

**Subject:** EPA Comments on CH2M Hill's Memo Re: April 5, 1998 Bunker Hill Long-Term Water Management - Results of Scoping Session (Scoping Memo)

**From:** Mary Kay Voytilla, EPA *Mary Kay Voytilla*

**To:** Joan Stoupa, CH2M Hill

Please find below comments offered by myself, Sean Sheldrake, and Nick Ceto of EPA. I have also attached comments from Patty McGrath of EPA's Office of Water, Earl Liverman, and Nick Zilka of IDEQ.

**General Comments:**

1. Please note that based on recent discussions with Mr. Collin Galloway of the Mine Safety & Health Administration (MSHA) we concluded that EPA employees, consultants, and other representatives performing CERCLA activities on New Bunker Hill Mining Company property did not require MSHA certification. However, anyone who goes underground is required to have mine emergency training, specific hazard training, and also be trained in the use of a self rescue device. (See attached letter from Collin R. Galloway).
2. In the re-write of the scoping memo, please include reference to the literature search and summary task that we have discussed. EPA anticipates that technical documents relevant to the Bunker Hill mine and the investigations being discussed will be identified, gathered, and very briefly summarized. This summary will be shared with the members of the long term water treatment work group (the work group).
3. Please briefly identify the purpose or goal for each of the areas for further study identified in the scoping memo.
4. Ultimately, as an end product of this effort, I will want to be able to compare the costs and effectiveness of CTP improvements or replacement vs. air doors, surface water diversions, and mine pluggings as approaches to managing mine water in the long term.



5. For future efforts, please consider and be mindful of the hydrologic connection between the Bunker Hill and Crescent mines.

Specific Comments:

6. Page 2 - Please briefly define and identify the purpose of "in-mine flumes."
7. Page 2 - Please consider the use of tracer studies as a tool to identify and quantify sources of highest acid mine drainage.
8. Page 2 - Please note how the various potential surface water diversions were identified. Are there others?
9. Page 3 - Please include a definition of "air doors."
10. Page 3, In-Mine Water Storage Capacity - This section references the existing Unilateral Administrative Order with the mine owner which requires water in the mine to be maintained at a certain level, as well as consideration of reducing the "buffer" between the portal and the South Fork of the Coeur d'Alene River. It should be noted that further understanding of the hydrologic connection of the mine to local surface and groundwater may first be required.
11. Attachment A - Nick Ceto, EPA's Mine Waste Coordinator for the Superfund program, identified several other mining sites where treatment issues are also being considered, including: the Greens Creek mine in Admiralty Island, Alaska (a treatment plant operates for zinc and lead using iron salts and polymers for precipitation); Summitville, Leadville, Eagle Mine, and the Argo Tunnel Treatment Plant all in Colorado; and the Berkeley Pit in Butte, Montana. For your information I have attached a "compliance document" from the Argo Tunnel Treatment Plant in Golden, Colorado, and a collection of cover pages from various studies of treatment of acid mine wastewater conducted by MSE, Inc. (the cover pages were handed out at a mining conference recently held at EPA, Region 10). As we proceed with this effort, it will be important to contact and coordinate with representatives from these and other sites.
12. Attachments A and B - The scoping memo should incorporate as a task, where appropriate, considerations of the remaining storage capacity in the current sludge pond, the estimated life of the current sludge pond, and discussion of other potential future disposal options for sludge (i.e., including and in addition to in-mine sludge disposal).
13. Attachment B - I have learned from Nick Ceto that there is currently some ongoing policy level discussions at EPA Headquarters as to whether mine water treatment sludges are exempt under the Bevill amendment. Potentially, if the sludge fails TCLP it may be illegal to put it back into the mine. As we go forward with this investigation process we will need to stay abreast of any legal developments.

14. Attachment B - Please consider the use of batch testing of acid mine drainage and sludge to determine if metals in sludges disposed in the mine could potentially remobilize.

15. Attachment C, page 3 - Please include in the scoping memo a brief discussion of the "current state of the art" in treatment of acid mine drainage.

#### Attachments

cc: w/o attachments  
Mike Thomas, IDEQ  
Nick Zilka, IDEQ  
Bill Hudson, CH2M Hill  
Sean Sheldrake, EPA  
Patty McGrath, EPA  
Jerry Lee, Terragraphics  
Jim Stefanoff, CH2M Hill

BA 5F 13.14.6

# Mine Safety & Health Administration

205 N. 4th Street - Room 103 • Coeur d'Alene, Idaho 83814 • (208)-667-6680 • Fax: (208)-765-3099

RECEIVED

APR 1 1998

OFFICE OF REGIONAL COUNSEL  
EPA - REGION X

March 30, 1998

Mr. Ted Yaculick  
Assistant Regional Counsel  
U.S. Environmental Protection Agency  
ORC-158  
1200 6th Avenue  
Seattle, Washington 98101

Dear Mr. Yaculick,

This letter is to follow-up on our telephone conversation last week regarding MSHA jurisdiction over the EPA, Idaho DEQ and any contractors working for either of the agencies performing remediation work on the Bunker Hill mine site.

Robert Hopper, President of Placer Mining Corporation has expressed concern about training of EPA/DEQ and their contractor employees according to the MSHA regulations found in 30 CFR, Part 48. I contacted Mr. Jim Salois, Western District Manager for MSHA and explained the situation to him. He informed me that MSHA cannot enforce the training regulations for EPA/DEQ or their contractors, even though they are performing remediation work on an active mine site.

Mr. Hopper also expressed concern about employees of Terragraphics entering the underground portion of the mine without his knowledge or consent. This cannot be tolerated. It is not only discourteous to Mr. Hopper, it is extremely dangerous. Anyone who goes underground is required to have mine emergency training, and also be trained in the use of a self-rescue device. Specific hazard training is also required for employees going underground.

Please ensure that EPA/DEQ employees and employees of their contractors comply with this requirement.

Please call me if you have any questions.

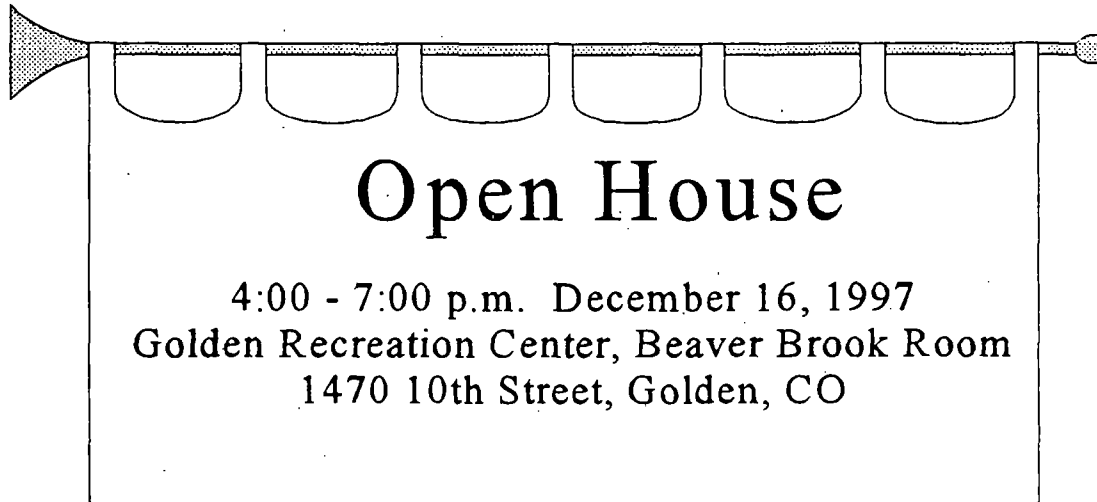
Respectfully,

*Collin R. Galloway*  
Collin R. Galloway  
Supervisory Mine Inspector

cc: Files

Robert Hopper, Placer Mining Corp.

# ARGO TUNNEL TREATMENT PLANT SUPERFUND COMPLIANCE DOCUMENT



## ARGO TUNNEL

- ➡ Untreated Argo Tunnel discharge largest source of heavy metal pollution in Clear Creek.
- ➡ CDPHE and EPA through Superfund have constructed a treatment plant to remove metals.
- ➡ Scheduled to start operating in January, 1998.

## WHAT IS THE COMPLIANCE DOCUMENT?

- ➡ The *Superfund Compliance Document* outlines the discharge limits and other requirements for the new Argo Tunnel Treatment Plant.
- ➡ Superfund Compliance Document Contents:
  - ➡ Effluent Limits
  - ➡ Monitoring Requirements
  - ➡ Reporting Requirements

- Superfund cleanups need to meet ARARs -- *Applicable, or Relevant and Appropriate Requirements*.
- Discharge limits are based on meeting Superfund - *Applicable or Relevant and Appropriate Requirements* (ARAR) such as water quality and drinking water supply standards or criteria. ARARs are the laws, regulations, standards, etc. that define the required level of cleanup at Superfund sites. The main ARARs for the Argo Treatment Plant are the water quality standards for Clear Creek, and Colorado and EPA NPDES regulations.
- Document specifies and applies the ARARs to the ARGO Treatment Plant.
- Similar to a NPDES (surface water discharge) permit.

## Public Comment

- Public comments are invited anytime prior to **December 29, 1997**  
Comments may be directed to:  
Dana Allen, Region VIII (8EPR-EP)  
U.S. Environmental Protection Agency  
999 18th Street, Suite 500  
Denver, Colorado 80202-2466
- For questions or more information please call Dana Allen at (303) 312-6870 or (800) 227-8917 X6870.
- All comments received prior to December 29, 1997, will be considered in the final Superfund Compliance Document. A response to comments will be prepared.

## Frequently Asked Questions:

- ① Are the requirements at Argo the same as similar NPDES or Superfund mine discharges?

**ANSWER:** The general regulatory approach is the same for all major NPDES and Superfund discharges. However, each NPDES permit or Superfund site has individual site specific requirements. The Argo requirements are in the same range as these other discharges. Some requirements are more restrictive than average, a few are less restrictive than average. For more information see the tables comparing the discharge requirements for the Argo and seven other mine discharges.

- ② Why do the discharge limits differ for similar facilities?

**ANSWER:** The limits are calculated based on the discharge flow, the flow of receiving stream, hardness, and water quality of the receiving stream and discharge. These conditions are different for every discharge. Different water quality standards have also been applied to individual stream segments. For example the standards change right at the Argo discharge. The mineralogy of the mining area may also effect discharge limits.

- ③ Will penalties be assessed if there are violations of the compliance document?

**ANSWER:** No. Unlike NPDES and Superfund clean-ups where a responsible party has been identified, there are no penalty provisions for Superfund lead remedial actions.

- ④ Do the Argo treatment plant owners/operators have to comply with the compliance document?

**ANSWER:** Yes. Compliance at the Argo treatment plant will be assessed and followed-up on just like NPDES permits and other Superfund discharges to surface water. (EPA and the State own the plant. A State contractor will operate the plant.)

# COMPARISON OF ARGO SUPERFUND COMPLIANCE DOCUMENT TO OTHER MINE DISCHARGE REQUIREMENTS

Draft	Argo Tunnel	Urad/Henderson Mines			Yak Tunnel Calif. Gulch		Leadville Tunnel	Black Cloud	Eagle Mine	Cripple Crk & Victor
Parameter	Effluent Limit*	Effluent Limit*	Effluent Limit*	Effluent Limit*	Eff. Limit in effect 'til 3/99	Eff. Limit in effect after 3/99	Effluent Limit*	Effluent Limit*	Effluent Limit*	Effluent Limit*
		Oct-May	June-July	Aug-Sept						
Aluminum (TRec.), ug/l	NL	NL	NL	NL	87/243 as	87/750 as	87/750 pd	NL	NL	NL
Cadmium (TRec.), ug/l	3 / -	2.3/8.3pd	1.5/4pd	1.7/5.3pd	3/25	1.2/4.2	1.4/4.4 pd	50/100	8/100	NL
Copper (TRec.), ug/l	17 / 35	24/35pd	13/19pd	17/24pd	12.4/48.7	12.4/18.7	13/19 pd	50/100	150/300	59/98
Iron (TRec.), ug/l	16000 / -	1400/ --	2600/ --	1800/ --	1000/ -	1000/ -	1000/ -	NL	3100/-(dis)	NL
Lead (TRec.), ug/l	4.75 / 905	0.96/240pd	1.9/60pd	4.4/110pd	3.5/88.9	3.5/88.9	4.5/112 pd	200/400	120/ -	30/920
Manganese, (TRec.), ug/l	800 / -	9400/ --	13,500/ --	10,500/ --	1000/ -	1000/ -	1000/ -	1,000/2,000	1200/ - 'til 1999 50/ - post '99	NL
Silver (TRec.), ug/l	0.02 / 0.62	--/ 5.3pd	--/ 1.2pd	--/ 2.3pd	NL	0.08/2.24	0.09/2.4	NL	NL	0.8/21.2
Zinc (TRec.), ug/l	225 / -	210/220	100/120pd	140/160pd	113/855	111/123	- / 127 pd	500/1000	400/1500	130/1000

\* Effluent Limit Format = Chronic Limit/Acute Limit  
 chronic = maximum monthly average  
 acute = maximum daily concentration

ug/L = Micrograms per liter, commonly parts per billion  
 TRec, pd, as = Analytical methods for determining metals concentrations  
 Total Recoverable, Potentially Dissolved and Acid Soluble

draft 12/97 (CHRONIC/ACUTE)	Argo Tunnel		Urad / Henderson Mines			
	Effluent Limit*	Monit. Freq.	Note #3	Effluent Limit*	Effluent Limit*	Monit. Freq.
Parameter	Note #1	Note #2	Oct-May	June-July	Aug-Sept	
Flow, mgd	1.008	D/C				D/C
pH, s.u.	6.5 / 9.0	D/C	<-----	6.5-9.0	----->	Weekly
Oil and Grease, mg/l	- / 10	Weekly	<-----	- / 10	----->	Weekly
TSS, mg/l	20 / 30	Weekly	<-----	20 / 30	----->	Weekly
Hardness, mg/l as CaCO3	NL	Weekly		NL		Weekly
Whole Effluent Toxicity, Acute	No Acute Toxicity	Quarterly				
Whole Effluent Toxicity, Chronic		-	<-----	No Chronic Toxicity	----->	Quarterly
Aluminum (TRec.), ug/l	NL	Weekly	NL	NL	NL	NM
Arsenic (TRec.), ug/l	- / 400	Weekly	NL	NL	NL	NM
Cadmium (TRec.), ug/l	3 / -	Weekly	2.3 / 8.3pd	1.5 / 4pd	1.7 / 5.3pd	Monthly
Copper (TRec.), ug/l	17 / 35	Weekly	24 / 35pd	13 / 19pd	17 / 24pd	Weekly
Iron (TRec.), ug/L	16000 / -	Weekly	1400 / --	2600 / --	1800 / --	Monthly
Lead (TRec.), ug/l	4.75 / 905	Weekly	0.96 / 210pd	1.9 / 30pd	4.4 / 110pd	Weekly
Manganese, (TRec.), ug/l	800 / -	Weekly	9400 / --	13,500 / --	10,500 / --	Weekly
Nitrate-N (Total), mg/l	NL	Bi-Month	0.015 / --	0.29 / --	0.20 / --	12X/Year
Nickel (TRec.), ug/l	850 / -	Weekly	NL	NL	NL	Weekly
Silver (TRec.), ug/l	0.02 / 0.62	Weekly	-- / 5.3pd	-- / 1.2pd	-- / 2.3pd	Weekly
Zinc (TRec.), ug/l	225 / -	Weekly	210 / 220	100 / 120pd	140 / 160pd	Weekly
Beryllium (TRec), ug/l	NL	Bi-Month	NL	NL	NL	NM
Chromium (TRec), ug/l	NL	Bi-Month	"	"	"	"
Chromium6+ (Diss.), ug/l	NL	Bi-Month	17/23	32 / 47	22/30	Monthly
Selenium (TRec), ug/l	NL	Bi-Month	NL	NL	NL	NM
Thallium (TRec), ug/l	NL	Bi-Month	"	"	"	"
Uranium (Diss), ug/l	NL	Bi-Month	"	"	"	"
Radium 226 and 228, PCi/l	NL	Bi-Month	"	"	"	"
Gross Alpha, PCi/l	NL	Bi-Month	"	"	"	"
Nitrate-N, mg/l	NL	Bi-Month	NL	NL	NL	NM
Nitrite-N, mg/l	NL	Bi-Month	"	"	"	"
Ammonia-N, mg/l	NL	Bi-Month	"	"	"	"
Cyanide, WAD ug/l	NL	Bi-Month	"	"	"	"
Total Phosphorous, mg/l	NL	Bi-Month	"	"	"	"
Influent Monitoring	YES	Bi-Month	NO			
Instream Monitoring	YES	Bi-Month	NO, but in earlier permits			
Owner or Operator	EPA & State		<-----	Cyprus Climax	----->	
NPDES or Superfund?	Superfund COU-0100		<-----	NPDES CO-41467	----->	
Draft						

## COMPARISON OF ARGO PLT

## TO OTHER MINE DISCHARGE REQUIREMENTS

draft 12/97 (CHRONIC/ACUTE)	Yak Tunnel California Gulch				Leadville Tunnel		Black Cloud	
Parameter	Eff Limit* til 1999	Mnt til 99	Eff Limit 99 & later	Mnt 99 and later	Effluent Limit*	Monit. Freq.	Effluent Limit*	Monit. Freq.
	Note #1	Note #2			Note #5		Note #6	
Flow, mgd	NL	D/C	NL	D/C	NL	D/C	Report	D/C
pH, s.u.	6.5/9.0	D/C	6.5/9.0	D/C	6.5/9.0	D/C	6.5-9.0	Weekly
Oil and Grease, mg/l	-/10	Weekly	-/10	Weekly	-/10	Weekly	-/10	Weekly
TSS, mg/l	20/30	Weekly	20/30	Weekly	30/45	Daily	20/30	Weekly
Hardness, mg/l as CaCO3	NL	Weekly	NL	Weekly	NL	Weekly	NL	Weekly
Whole Effluent Toxicity, Acute	No Acute Toxicity	Quarterly	No Acute Toxicity	Quarterly	No Acute Toxicity	NM	--	NM
Whole Effluent Toxicity, Chronic	NL	2X/ Year	NL	2X/ Year	No Chronic Toxicity	Quarterly	No Chronic Toxicity	Quarterly
Aluminum (TRec.), ug/l	87/ 243 as	Quarterly	87/ 750 as	Quarterly	87/ 750 pd	Weekly	NL	NM
Arsenic (TRec.), ug/l	50/ 50	Quarterly	50/ 50	Quarterly	50/ 50	Weekly	NL	NM
Cadmium (TRec.), ug/l	3/ 25	Weekly	1.2/ 4.2	Weekly	1.4/ 4.4 pd	Weekly	50/ 100	Quarterly
Copper (TRec.), ug/l	12.4/ 48.7	Weekly	12.4/ 18.7	Weekly	13/ 19 pd	Weekly	50/ 100	Weekly
Iron (TRec.), ug/l	1000/-	Quarterly	1000/-	Quarterly	1000/-	Weekly	NL	NM
Lead (TRec.), ug/l	3.5/ 88.9	Weekly	3.5/ 88.9	Weekly	4.5/ 112 pd	Weekly	200/ 400	Weekly
Manganese (TRec.), ug/l	1000/-	Quarterly	1000/-	Quarterly	1000/-	Weekly	1,000/2,000	Weekly
Nickel (TRec.), ug/l	NL	Weekly	0.01/2.4	Weekly	0.01/-	Weekly	1/10/10	Quarterly
Nickel (TRec.), ug/l	NL	6X	NL	NM	NL	NM	NL	Weekly
Silver (TRec.), ug/l	NL	Annually	0.08/2.24		0.09/2.4	Weekly	NL	NM
Zinc (TRec.), ug/l	113/ 855	Weekly	111/ 123	Weekly	-/ 127 pd	Weekly	500/ 1000	Weekly
Beryllium (TRec), ug/l	NL	NM	NL	NM	NL	NM	NL	NM
Chromium (TRec), ug/l	50/ 50	Annually	50/ 50	Annually	"	"	"	"
Chromium6+ (Diss.), ug/l	NL	NM	NL	NM	"	"	"	"
Selenium (TRec), ug/l	5/ 26.5	Weekly	5/ 10	Weekly	--/10	Weekly	"	"
Thallium (TRec), ug/l	NL	NM	NL	NM	NL	NM	"	"
Uranium (Diss), ug/l	"	6X	"	"	"	"	"	"
Radium 226 and 228, PCi/l	"	6X	"	"	"	"	"	"
Gross Alpha, PCi/l	"	6X	"	"	"	"	"	"
Nitrate-N, mg/l	NL	NM	NL	NM	NL	NM	NL	NM
Nitrite-N, mg/l	"	"	"	"	"	"	--	
Ammonia-N, mg/l	"	"	"	"	"	"	4500	Weekly
Cyanide, WAD ug/l	"	"	"	"	"	"	100/ 200(T)	Monthly
Total Phosphorous, mg/l	"	6X	"	"	"	"	NL	NM
Influent Monitoring	NO				NO		NO	
Instream Monitoring	YES				YES - 1ST 3 YEARS		NO	
Owner or Operator		Res - ASARCO			US BOR		Res-ASARCO	
NPDES or Superfund?		Superfund	CO-00099		NPDES CO-21717		NPDES CO-00591	
Draft								

## COMPARISON OF ARGO PLT

## TO OTHER MINE DISCHARGE REQUIREMENTS

draft 12/97 (CHRONIC/ACUTE)	Eagle Mine		Cripple Creek & Victor	
Parameter	Effluent Limit*	Monit. Freq.	Effluent Limit*	Monit. Freq.
	Note #7,8		Note #9	
Flow, mgd	0.396-0.454	D/C	2.58	2X/Month
pH, s.u.	6.5-9.0	D/C	6.5/ 9.0	2X/Month
Oil and Grease, mg/l	- /10	Weekly	- / 10	2X/Month
TSS, mg/l	20/ 30	Weekly	30/	2X/Month
Hardness, mg/l as CaCO3	NL	Weekly	NL	NM
Whole Effluent Toxicity, Acute	No Acute Toxicity	Quarterly	No Acute Toxicity	2X/Year
Whole Effluent Toxicity, Chronic			No Chronic Toxicity	
Aluminum (TRec.), ug/l	NL	NM	NL	NM
Arsenic (TRec.), ug/l	NL	NM	NL	NM
Cadmium (TRec.), ug/l	8/ 100	2X/Mon	NL	NM
Copper (TRec.), ug/l	150/ 300	Weekly	59/ 98pd	2X/Month
Iron (TRec.), ug/L	3100/- (dis)	Weekly	NL	NM
Lead (TRec.), ug/l	120/ -	2X/Mon	30/ 920pd	2X/Month
Manganese, (TRec.), ug/l	1200/ - til 1999 50/ -	Weekly	NL	NM
Mercury (Total), ug/l	NL	NM	NL	NM
Nickel (TRec.), ug/l	NL	NM	NL	NM
Silver (TRec.), ug/l	NL	NM	0.8/ 21.2pd	2X/Month
Zinc (TRec.), ug/l	400/ 1500	Weekly	130/ 1000pd	2X/Month
Beryllium (TRec), ug/l	NL	NM	NL	NM
Chromium (TRec), ug/l	"	"	"	"
Chromium6+ (Diss.), ug/l	"	"	"	"
Selenium (TRec), ug/l	"	"	"	"
Thallium (TRec), ug/l	"	"	"	"
Uranium (Diss), ug/l	"	"	"	"
Radium 226 and 228, PCi/l	"	"	"	"
Gross Alpha, PCi/l	"	"	"	"
Nitrate-N, mg/l	NL	NM	NL	NM
Nitrite-N, mg/l	"	"	"	"
Ammonia-N, mg/l	"	"	"	"
Cyanide, WAD ug/l	"	"	"	"
Total Phosphorous, mg/l	"	"	"	"
Influent Monitoring	NO		NO	
Instream Monitoring	NO		NO	
Owner or Operator	Viacom Intern		Cripple Creek and Victor Gold	
NPDES or Superfund?	NPDES CO-42480		NPDES CO-24562	
Draft			Carlton Tunnel only, 2nd permit for Arista Gulch	

## Abbreviation and Notes

* Effluent Limit Format: Chronic Limit/Acute Limit	
D/C	daily/continuous monitoring
S.U.	standard units of pH
NL	no limit
NM	no monitoring
Bi-monthly	Every other month
pd	Potentially Dissolved analytical method (PD)
as	Acid Soluble analytical method
TRec	Total Recoverable analytical method
TVS	Table Value Standard - Colorado Water Quality Standards most calculated by
	formulas based on hardness.
Note 1	Argo Final Limits and monitoring from draft ARARs compliance document dated November 24, 1997.
Note 2	Bi-monthly 1st year. Argo monitoring changes to quarterly the second year of operations.
Note 3	Cyprus Climax (formerly Climax Molybdenum) permit dated February 28, 1997, for Urad Millsite and Henderson Mine. Permits have limits for three seasons (Oct-May, June-July, and Aug-Sept) and three minewater flow conditions (low, medium, and high). This Table shows the low-flow concentration limits.
Note 4	Yak Tunnel discharge control mechanism, draft final 2/94.
Note 5	U.S. BOR, Leadville Drain Tunnel dated April 29, 1992
Note 6	Resurrection-ASARCO permit dated May 12, 1992, amended July 1994.
Note 7	Eagle Mine permit for Viacom dated October 11, 1996.
Note 8	Eagle Mine manganese limit decreases to 50 ug/l dissolved in January 1999.
Note 9	Cripple Creek and Victor permit amended January 6, 1993. Separate permit for Ariestra Gulch and expansion

draft 12-97 WQS	Argo Tunnel		Urad / Henderson Mines		Yak Tunnel California Gulch	
Parameter	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS
	Clear Creek		Woods and W.F. Clear Ck		Cal. Gulch/	Arkansas R.
Aluminum (TRec.), ug/l	no ch	no ac	no ch	no ac		
Arsenic (TRec.), ug/l	no ch	50	100	no ac	50	50
Cadmium (Dis), ug/l			TVS=1.51, 0.54, 0.90*	TVS=5.92, 1.36, 2.79*	9.0	TVS=4.2
Cadmium (TRec.), ug/l	3	no ac				
Copper (Dis), ug/l			TVS=16.15, 5.29, 9.1*	TVS=25, 7.3, 13.4*	TVS=12.43	TVS=18.74
Copper (TRec), ug/l	17	no ac				
Iron (Dis), ug/L	300	no ac				
Iron (TRec), ug/L	1000	no ac	1000	no ac	1700	no ac
Lead (Dis), ug/l	TVS=1.5	TVS=31.3	TVS=6.52, 1.03, 2.5*	TVS=172.7, 21.0, 58.9	TVS=4.23	TVS=105.3
Lead (TRec), ug/l						
Manganese, (Dis), ug/l	50	no ac	TVS=6,400, 2,650, 4,090	no ac		
Manganese, (Trec.), ug/l	1000	no ac			2500	no ac
Mercury (Total), ug/l	0.01	no ac	0.01	no ac	0.01	no ac
Silver (Dis.), ug/l	TVS(tr)=0.02	TVS=0.64	TVS=0.14, 0.015, 0.015*	TVS=3.8, 0.402, 1.21*	TVS=2.24	TVS=2.24
Silver (TRec.), ug/l			effective 3/2/98			
Zinc (Dis), ug/l			TVS=144, 47.7, 82.1*	TVS=159, 52.7, 90.7*	2,700 til 98, TVS = 112 in 1999	TVS=228.28, no ac
Zinc (TRec.), ug/l	300	no ac				
			* TVS calculated using seasonable hardness			
Owner or Operator	EPA &		←	Cyrus Climax	ASARCO	
NPDES or Superfund?	Superfund COU-0100		←	NPDES CO-41467	Superfund CO-O	
Draft						

## COMPARISON OF ARGO WQS TO WQS AT OTHER MINES

12/16/97, 10:51 AM,2

draft 12-97 WQS	Leadville Tunnel		Black Cloud		Eagle Mine		Cripple Creek and Victor	
Parameter	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS
	Arkansas R., Seg 2a		Iowa Gulch / Arkansas R.		El Je River, Seg 3		4-Mile/ Arcata G.	
Aluminum (TRec.), ug/l	no ch	no ac	no ch	no ac	no ch	no ac	no ch	no ac
Arsenic (TRec.), ug/l	50	50	no ch	no ac	50			
Cadmium (Dis), ug/l	1.4	TVS=4.37					2	95
Cadmium (TRec.), ug/l			100	no ac	1	no ac		
Copper (Dis), ug/l	TVS=12.83	TVS=19.4					23	37
Copper (TRec), ug/l			50	no ac	14			
Iron (Dis), ug/L								
Iron (TRec), ug/L	1000	no ac			1,000			
Lead (Dis), ug/l	TVS=4.45	TVS=111.8					12	342
Lead (TRec), ug/l			200	no ac	9	no ac		
Manganese (Dis), ug/l								
Manganese (Trec.), ug/l	1000	no ac	1000	no ac	1,000	no ac		
Mercury (Total), ug/l	0.01	no ac	1	no ac	0.05	no ac	10	NA
Silver (Dis.), ug/l	TVS=0.38	TVS=2.39						
Silver (TRec.), ug/l					0.1			
Zinc (Dis), ug/l	365	TVS=126.9					54	412
Zinc (TRec.), ug/l			500	no ac	400	no ac		
Owner or Operator	US BOR		Res-ASARCO		Jiacom Intern.		Cripple Creek and Victor Co	
NPDES or Superfund?	NPDES CO-21717		NPDES CO-00591		NPDES CO-42480		NPDES CO-24562	
Draft								

WATER QUALITY STANDARDS (WQS)

## COMPARISON OF ARGO PLT

## TO OTHER MINE DISCHARGE REQUIREMENTS

draft 12/97 (CHRONIC/ACUTE)	Argo Tunnel		Urad / Henderson Mines			
Parameter	Effluent Limit*	Monit. Freq.	Effluent Limit*	Effluent Limit*	Effluent Limit*	Monit. Freq.
	Note #1	Note #2	Oct-May	June-July	Aug-Sept	
Flow, mgd	1.008	D/C				D/C
pH, s.u.	6.5 / 9.0	D/C	<-----	6.5-9.0	----->	Weekly
Oil and Grease, mg/l	- / 10	Weekly	<-----	- / 10	----->	Weekly
TSS, mg/l	20 / 30	Weekly	<-----	20 / 30	----->	Weekly
Hardness, mg/l as CaCO3	NL	Weekly		NL		Weekly
Whole Effluent Toxicity, Acute	No Acute Toxicity	Quarterly				
Whole Effluent Toxicity, Chronic		-	<-----	No Chronic Toxicity	----->	Quarterly
Aluminum (TRec.), ug/l	NL	Weekly	NL	NL	NL	NM
Arsenic (TRec.), ug/l	- / 400	Weekly	NL	NL	NL	NM
Cadmium (TRec.), ug/l	3 / -	Weekly	2.3 / 8.3pd	1.5 / 4pd	1.7 / 5.3pd	Monthly
Copper (TRec.), ug/l	17 / 35	Weekly	24 / 35pd	13 / 19pd	17 / 24pd	Weekly
Iron (TRec.), ug/L	16000 / -	Weekly	1400 / --	2600 / --	1800 / --	Monthly
Lead (TRec.), ug/l	4.75 / 905	Weekly	0.96 / 240pd	0.9 / 60pd	0.4 / 110pd	Weekly
Manganese, (TRec.), ug/l	800 / -	Weekly	9400 / --	13,500 / --	10,500 / --	Weekly
Mercury (Total), ug/l	NL	Bi-Month	0.015 / --	0.029 / --	0.020 / --	2X/Year
Nickel (TRec.), ug/l	850 / -	Weekly	NL	NL	NL	Weekly
Silver (TRec.), ug/l	0.02 / 0.62	Weekly	-- / 5.3pd	-- / 1.2pd	-- / 2.3pd	Weekly
Zinc (TRec.), ug/l	225 / -	Weekly	210 / 220	100 / 120pd	140 / 160pd	Weekly
Beryllium (TRec.), ug/l	NL	Bi-Month	NL	NL	NL	NM
Chromium (TRec.), ug/l	NL	Bi-Month	"	"	"	"
Chromium6+ (Diss.), ug/l	NL	Bi-Month	17/23	32 / 47	22/30	Monthly
Selenium (TRec.), ug/l	NL	Bi-Month	NL	NL	NL	NM
Thallium (TRec.), ug/l	NL	Bi-Month	"	"	"	"
Uranium (Diss), ug/l	NL	Bi-Month	"	"	"	"
Radium 226 and 228, PCi/l	NL	Bi-Month	"	"	"	"
Gross Alpha, PCi/l	NL	Bi-Month	"	"	"	"
Nitrate-N, mg/l	NL	Bi-Month	NL	NL	NL	NM
Nitrite-N, mg/l	NL	Bi-Month	"	"	"	"
Ammonia-N, mg/l	NL	Bi-Month	"	"	"	"
Cyanide, WAD, ug/l	NL	Bi-Month	"	"	"	"
Total Phosphorous, mg/l	NL	Bi-Month	"	"	"	"
Influent Monitoring	YES	Bi-Month	NO			
Instream Monitoring	YES	Bi-Month	NO, but in earlier permits			
Owner or Operator	EPA & State		<-----	Cyprus Climax	----->	
NPDES or Superfund?	Superfund COU-0100		<-----	NPDES CO-41467	----->	
Draft						

## COMPARISON OF ARGO PLT

## TO OTHER MINE DISCHARGE REQUIREMENTS

draft 12/97 (CHRONIC/ACUTE)	Yak Tunnel California Gulch				Leadville Tunnel		Black Cloud	
Parameter	Eff Limit* til 1999	Mnt til 99	Eff Limit 99 & later	Mnt 99 and later	Effluent Limit*	Monit. Freq.	Effluent Limit*	Monit. Freq.
	Note #1	Note #2			Note #5		Note #6	
Flow, mgd	NL	D/C	NL	D/C	NL	D/C	Report	D/C
pH, s.u.	6.5/ 9.0	D/C	6.5/ 9.0	D/C	6.5/ 9.0	D/C	6.5-9.0	Weekly
Oil and Grease, mg/l	-/ 10	Weekly	-/ 10	Weekly	-/ 10	Weekly	-/ 10	Weekly
TSS, mg/l	20/ 30	Weekly	20/ 30	Weekly	30/45	Daily	20/30	Weekly
Hardness, mg/l as CaCO3	NL	Weekly	NL	Weekly	NL	Weekly	NL	Weekly
Whole Effluent Toxicity, Acute	No Acute Toxicity	Quarterly	No Acute Toxicity	Quarterly	No Acute Toxicity	NM	--	NM
Whole Effluent Toxicity, Chronic	NL	2X/ Year	NL	2X/ Year	No Chronic Toxicity	Quarterly	No Chronic Toxicity	Quarterly
Aluminum (TRec.), ug/l	87/ 243 as	Quarterly	87/ 750 as	Quarterly	87/ 750 pd	Weekly	NL	NM
Arsenic (TRec.), ug/l	50/ 50	Quarterly	50/ 50	Quarterly	50/ 50	Weekly	NL	NM
Cadmium (TRec.), ug/l	3/ 25	Weekly	1.2/ 4.2	Weekly	1.4/ 4.4 pd	Weekly	50/ 100	Quarterly
Copper (TRec.), ug/l	12.4/ 48.7	Weekly	12.4/ 18.7	Weekly	13/ 19 pd	Weekly	50/ 100	Weekly
Iron (TRec.), ug/L	1000/ -	Quarterly	1000/ -	Quarterly	1000/ -	Weekly	NL	NM
Lead (TRec.), ug/l	3.5/ 88.9	Weekly	3.5/ 88.9	Weekly	4.5/ 112 pd	Weekly	200/ 400	Weekly
Manganese (TRec.), ug/l	1000/ -	Quarterly	1000/ -	Quarterly	1000/ -	Weekly	1,000/ 2,000	Weekly
Nickel (TRec.), ug/l	NL	Weekly	0.12/ 2.4	Weekly	0.09/ 2.4	Weekly	5/ 10/ 20	Quarterly
Nickel (TRec.), ug/l	NL	6X	NL	NM	NL	NM	NL	Weekly
Silver (TRec.), ug/l	NL	Annually	0.08/ 2.24		0.09/ 2.4	Weekly	NL	NM
Zinc (TRec.), ug/l	113/ 855	Weekly	111/ 123	Weekly	-/ 127 pd	Weekly	500/ 1000	Weekly
Beryllium (TRec.), ug/l	NL	NM	NL	NM	NL	NM	NL	NM
Chromium (TRec.), ug/l	50/ 50	Annually	50/ 50	Annually	"	"	"	"
Chromium6+ (Diss.), ug/l	NL	NM	NL	NM	"	"	"	"
Selenium (TRec.), ug/l	5/ 26.5	Weekly	5/ 10	Weekly	--/ 10	Weekly	"	"
Thallium (TRec.), ug/l	NL	NM	NL	NM	NL	NM	"	"
Uranium (Diss), ug/l	"	6X	"	"	"	"	"	"
Radium 226 and 228, PCi/l	"	6X	"	"	"	"	"	"
Gross Alpha, PCi/l	"	6X	"	"	"	"	"	"
Nitrate-N, mg/l	NL	NM	NL	NM	NL	NM	NL	NM
Nitrite-N, mg/l	"	"	"	"	"	"	--	
Ammonia-N, mg/l	"	"	"	"	"	"	4500	Weekly
Cyanide, WAD ug/l	"	"	"	"	"	"	100/ 200(T)	Monthly
Total Phosphorous, mg/l	"	6X	"	"	"	"	NL	NM
Influent Monitoring	NO				NO		NO	
Instream Monitoring	YES				YES - 1ST 3 YEARS		NO	
Owner or Operator		Res - ASARCO			US BOR		Res-ASARCO	
NPDES or Superfund?		Superfund CO-00099			NPDES CO-21717		NPDES CO-00591	
Draft								

draft 12/97 (CHRONIC/ACUTE)	Eagle Mine		Cripple Creek & Victor	
Parameter	Effluent Limit*	Monit. Freq.	Effluent Limit*	Monit. Freq.
	Note #7,8		Note #9	
Flow, mgd	0.396-0.454	D/C	2.58	2X/Month
pH, s.u.	6.5-9.0	D/C	6.5/ 9.0	2X/Month
Oil and Grease, mg/l	- /10	Weekly	- / 10	2X/Month
TSS, mg/l	20/ 30	Weekly	30/	2X/Month
Hardness, mg/l as CaCO3	NL	Weekly	NL	NM
Whole Effluent Toxicity, Acute	No Acute Toxicity	Quarterly	No Acute Toxicity	2X/Year
Whole Effluent Toxicity, Chronic			No Chronic Toxicity	
Aluminum (TRec.), ug/l	NL	NM	NL	NM
Arsenic (TRec.), ug/l	NL	NM	NL	NM
Cadmium (TRec.), ug/l	8/ 100	2X/Mon	NL	NM
Copper (TRec.), ug/l	150/ 300	Weekly	59/ 98pd	2X/Month
Iron (TRec.), ug/L	3100/- (dis)	Weekly	NL	NM
Lead (TRec.), ug/l	120/ -	2X/Mon	30/ 920pd	2X/Mon
Manganese, (TRec.), ug/l	1200/ - til 1999 50/ -	Weekly	NL	NM
Mercury (Total), ug/l	22299	NM	NL	NM
Nickel (TRec.), ug/l	NL	NM	NL	NM
Silver (TRec.), ug/l	NL	NM	0.8/ 21.2pd	2X/Month
Zinc (TRec.), ug/l	400/ 1500	Weekly	130/ 1000pd	2X/Month
Beryllium (TRec), ug/l	NL	NM	NL	NM
Chromium (TRec), ug/l	"	"	"	"
Chromium6+ (Diss.), ug/l	"	"	"	"
Selenium (TRec), ug/l	"	"	"	"
Thallium (TRec), ug/l	"	"	"	"
Uranium (Diss), ug/l	"	"	"	"
Radium 226 and 228, PCi/l	"	"	"	"
Gross Alpha, PCi/l	"	"	"	"
Nitrate-N, mg/l	NL	NM	NL	NM
Nitrite-N, mg/l	"	"	"	"
Ammonia-N, mg/l	"	"	"	"
Cyanide, WAD ug/l	"	"	"	"
Total Phosphorous, mg/l	"	"	"	"
Influent Monitoring	NO		NO	
Instream Monitoring	NO		NO	
Owner or Operator	Viacom Intern		Cripple Creek and Victor Gold	
NPDES or Superfund?	NPDES CO-42480		NPDES CO-24562	
Draft			Carton Tunnel only, 2nd permit for Arista Gulch	

## Abbreviation and Notes

### \* Effluent Limit Format: Chronic Limit/Acute Limit

D/C	daily/continuous monitoring
S.U.	standard units of pH
NL	no limit
NM	no monitoring
Bi-monthly	Every other month
pd	Potentially Dissolved analytical method (PD)
as	Acid Soluble analytical method
TRec	Total Recoverable analytical method
TVC	Table Value Standard - Colorado Water Quality Standards, most calculated by formulas based on hardness.
Note 1	Argo Final Limits and monitoring from draft ARARs compliance document dated November 24, 1997.
Note 2	Bi-monthly 1st year. Argo monitoring changes to quarterly the second year of operations.
Note 3	Cyprus Climax (formerly Climax Molybdenum) permit dated February 28, 1997, for Urad Millsite and Henderson Mine. Permits have limits for three seasons (Oct-May, June-July, and Aug-Sept) and three minewater flow conditions (low, medium, and high). This Table shows the low-flow concentration limits.
Note 4	Yak Tunnel discharge control mechanism, draft final 2/94.
Note 5	U.S. BOR, Leadville Drain Tunnel dated April 29, 1992
Note 6	Resurrection-ASARCO permit dated May 12, 1992, amended July 1994.
Note 7	Eagle Mine permit for Viacom dated October 11, 1996.
Note 8	Eagle Mine manganese limit decreases to 50 ug/l dissolved in January 1999.
Note 9	Cripple Creek and Victor permit amended January 6, 1993. Separate permit for Ariestra Gulch and expansion

draft 12-97 WQS	Argo Tunnel		Urad / Henderson Mines		Yak Tunnel California Gulch	
Parameter	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS
	Clear Creek		Woods and W. F. Clear Creek		Cal. Gulch	Arkansas R.
Aluminum (TRec.), ug/l	no ch	no ac	no ch	no ac		
Arsenic (TRec.), ug/l	no ch	50	100	no ac	50	50
Cadmium (Dis), ug/l			TVS=1.51, 0.54, 0.90*	TVS=5.92, 1.36, 2.79*	9.0	TVS=4.2
Cadmium (TRec.), ug/l	3	no ac				
Copper (Dis), ug/l			TVS=16.15, 5.29, 9.1*	TVS=25, 7.3, 13.4*	TVS=12.43	TVS=18.74
Copper (TRec), ug/l	17	no ac				
Iron (Dis), ug/L	300	no ac				
Iron (TRec), ug/L	1000	no ac	1000	no ac	1700	no ac
Lead (Dis), ug/l	TVS=1.5	TVS=31.3	TVS=6.52, 1.03, 2.5*	TVS=172.7, 21.0, 58.9	TVS=4.23	TVS=105.3
Lead (TRec), ug/l						
Manganese, (Dis), ug/l	50	no ac	TVS=6,400, 2,650, 4,090	no ac		
Manganese, (Trec.), ug/l	1000	no ac			2500	no ac
Mercury (Total), ug/l	0.01	no ac	0.01	no ac	0.01	no ac
Silver (Dis.), ug/l	TVS(tr)=0.02	TVS=0.64	TVS=0.14, 0.015, 0.045*	TVS=3.8, 0.402, 1.21*	TVS=2.24	TVS=2.24
Silver (TRec.), ug/l			effective 3/2/98			
Zinc (Dis), ug/l			TVS=144, 47.7, 82.1*	TVS=159, 52.7, 90.7*	2,700 til 98, TVS = 112 in 1999	TVS=228.28, no ac
Zinc (TRec.), ug/l	300	no ac				
			* TVS calculated using seasonal hardness			
Owner or Operator	EPA &		←	Cyrus Climax	ASARCO	
NPDES or Superfund?	Superfund COU-0100		←	NPDES CO-41467	Superfund CO-O	
Draft						

## COMPARISON OF ARGO WQS TO WQS AT OTHER MINES

12/16/97, 10:51 AM,2

draft 12-97 WQS	Leadville Tunnel		Black Cloud		Eagle Mine		Cripple Creek and Victor	
Parameter	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS	Chronic WQS	Acute WQS
	Arkansas R., Seg 2a		Iowa Gulch / Arkansas R.		Eagle River, Seg 5		4-Mile/ Arcata G.	
Aluminum (TRec.), ug/l	no ch	no ac	no ch	no ac	no ch	no ac	no ch	no ac
Arsenic (TRec.), ug/l	50	50	no ch	no ac	50			
Cadmium (Dis), ug/l	1.4	TVS=4.37					2	95
Cadmium (TRec.), ug/l			100	no ac	1	no ac		
Copper (Dis), ug/l	TVS=12.83	TVS=19.4					23	37
Copper (TRec), ug/l			50	no ac	14			
Iron (Dis), ug/L								
Iron (TRec), ug/L	1000	no ac			1,000			
Lead (Dis), ug/l	TVS=4.45	TVS=111.8					12	342
Lead (TRec), ug/l			200	no ac	9	no ac		
Manganese (Dis), ug/l								
Manganese (Trec.), ug/l	1000	no ac	1000	no ac	1,000	no ac		
Mercury (Total), ug/l	0.01	no ac	1	no ac	0.05	no ac	10	NA
Silver (Dis.), ug/l	TVS=0.38	TVS=2.39						
Silver (TRec.), ug/l					0.1			
Zinc (Dis), ug/l	365	TVS=126.9					54	412
Zinc (TRec.), ug/l			500	no ac	400	no ac		
Owner or Operator	US BOR		Res-ASARCO		Viacom Intern.		Cripple Creek and Victor Co	
NPDES or Superfund?	NPDES CO-21717		NPDES CO-00591		NPDES CO-42480		NPDES CO-24562	
Draft								

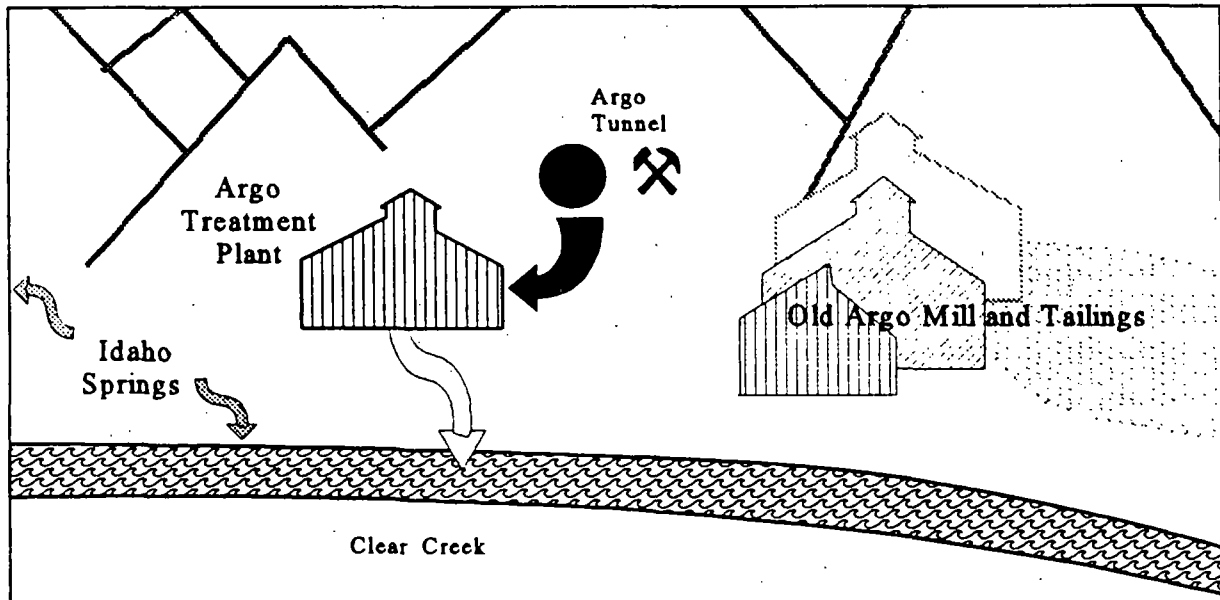
DRAFT - NOVEMBER 24, 1997

CLEAR CREEK/CENTRAL CITY SUPERFUND SITE  
ARGO TUNNEL TREATMENT PLANT  
IDAHO SPRINGS, COLORADO

APPLICABLE OR RELEVANT AND APPROPRIATE  
REQUIREMENTS COMPLIANCE DOCUMENT

PART 1 - APPLICATION OF ARARS  
PART 2 - DISCHARGE CONTROL MECHANISM

November 24, 1997



# ARGO TUNNEL WATER TREATMENT PLANT APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS COMPLIANCE DOCUMENT

## Summary - ARARs Compliance Document

The *Applicable or Relevant and Appropriate Requirements (ARAR) Compliance Document* outlines the discharge limits that will need to be met by the new Argo Tunnel Treatment Plant. Acid mine drainage from the Argo Tunnel will be treated by the plant to remove metals resulting in improved water quality in Clear Creek. Prior to starting the treatment plant, the tunnel has been discharging over 700 pounds per day of heavy metals into Clear Creek.

This document applies the requirements of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA or more commonly Superfund), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and Superfund - Applicable or Relevant and Appropriate Requirements (ARAR).

The document is divided into two parts; the Application of ARARs (Statement of Basis) and the Discharge Control Mechanism (DCM). Application of ARARs, Part I, explains: (1) which ARARs apply to the treatment plant, (2) how the ARARs are implemented, (3) outlines how compliance with ARARs will be determined, and (4) identifies other information that EPA and the State will need for evaluating treatment performance. Part II, the discharge control mechanisms, specifies the limits, monitoring and reporting that will be needed to ensure compliance with ARARs, and document plant performance and water quality.

## Table of Contents

### PART 1 - APPLICATION OF ARARs (Statement Of Basis )

- ☐ Background
- ☐ Applicable or Relevant and Appropriate Requirements
- ☐ Monitoring and Record Keeping Requirements
- ☐ Contacts/Addresses
- ☐ Discharge and Monitoring Locations
- ☐ Water Quality Standards
- ☐ Identifying Pollutants of Concern
- ☐ Determining Effluent Limitations
- ☐ Interim Limits
- ☐ Calculation of Final Discharge Limits

### PART 2 - DISCHARGE CONTROL MECHANISM (See DCM for detailed Table of Contents)

- ☐ Interim Effluent Limitations and Monitoring Requirements (Section I. C.)
- ☐ Final Effluent Limitations (Section I. D.)
- ☐ Final Monitoring Requirements (Section I. E.)
- ☐ Monitoring, Recording and Reporting Requirements (Section II.)
- ☐ Compliance Responsibilities (Section III.)
- ☐ General Requirements (Section IV.)  
(e.g. plant changes, spills, reopener, etc.)

## Background

### Clear Creek Superfund Site History:

The Clear Creek/Central City Superfund Site is located on the east slope of Colorado's Front Range. The Colorado Mineral Belt transects the Site. The rich mineralization of the area is the source of sulfide ores which contain deposits of several metals including gold, silver, iron, copper lead, nickel, zinc, cadmium, manganese, as well as others.

Due to the rich mineralization of the area, portions of the site became some of the most heavily mined areas of Colorado. There are well over 800 inactive mines and tunnels in Clear Creek and Gilpin Counties. Historically, it is estimated that over \$110 million worth of mineral production, in "1900" dollars, occurred at the Site. Gold and silver accounted for the vast majority of the mining interest.

Mining activity in the area commenced in 1859 with placer gold being found at the mouth of Chicago Creek, and, and the first lode discovery occurring in Gregory Gulch later that year. By the summer of 1860, almost all surface lodes had been claimed.

Extraction of surface ores led to an increase in the depth of mining. Tunneling brought problems with water drainage, and miners began to encounter more durable sulfide ores which could not be milled with the same ease as the oxidized surface ores. To compensate for these problems, drainage tunnels were constructed and new milling techniques were developed.

The tunnels and new milling techniques opened much of the mineralized area to oxygen and water creating continuing releases of heavy metal pollution. Sulfide ore when exposed to air, water and bacteria starts oxidizing, generating acid mine drainage and dissolving heavy metals. Once started, the oxidation reaction usually continues for many hundreds of years. The ongoing heavy metals releases from acid mine drainage and old tailings piles prompted EPA to list the historic mining areas of Clear Creek and Gilpin County as a Superfund site.

In May 1980, there was also a "blowout" of the Argo Tunnel. A blowout is a sudden gush of water and debris from a mine tunnel usually caused by the build up and eventual release of water trapped behind debris dams inside the tunnel. Acidic and metal-laden water and sediment from the Argo Tunnel blowout contaminated Clear Creek for many miles downstream of Idaho Springs. Coors Brewing Company and several municipalities who rely on Clear Creek for drinking water and industrial uses shut off their water intakes for approximately two days.

Based on the continuing releases of heavy metals and the Argo blowout, the U.S. Environmental Protection Agency (EPA) placed the Clear Creek/Central City Superfund Site (the Site) on the National Priorities List in 1983. The Site consists of a number of "priority locations" scattered over the Clear Creek watershed. The priority locations are the "worst actors" when it comes to impacts on Clear Creek.

## Argo Tunnel History:

One of the Superfund priority locations is the Argo Tunnel, located in Idaho Springs, Clear Creek County, Colorado (see Figure 1). The 4.2-mile long tunnel was driven between 1893 and 1910 so that gold mines in the area above the tunnel would be drained of water. The tunnel was also used to haul ore out of the mines. The tunnel has not been used for mining since 1943.

The Argo Tunnel drains hundreds of mines between Idaho Springs and Central City, Colorado. Currently, the Argo Tunnel drains mine water from old mines and the mountains above it at an average rate of 200 gallons per minute. However, during spring run off and periods of prolonged precipitation, the discharge rate can increase substantially. Large flows can also occur when portions of old mine workings collapse. The water is acidic with a pH ranging between two and three standard units. The drainage adds more than 700 pounds of metals per day into Clear Creek. This represents approximately one third of the total metals loading to Clear Creek. The effluent is toxic to aquatic life in Clear Creek.

EPA began a Remedial Investigation (RI) of the Clear Creek/Central City Site in June 1985. This RI focused on acid mine drainage from five abandoned mine tunnels near the cities of Idaho Springs, Black Hawk, and Central City and the influences of acid mine drainage from those tunnels on adjacent streams. The study was considered Operable Unit #1 (OU1) for the Site. The Argo Tunnel was one of the five tunnels investigated during the OU1 RI. The OU1 Record of Decision (ROD) was issued on September 30, 1987. The OU1 ROD chose treatment of the drainages from the five tunnels using constructed wetlands if it could be shown through a period of research that constructed wetlands were cost-effective and could consistently and effectively remove metals from mine drainage.

In June 1988, EPA transferred the lead role for the Site to the Colorado Department of Public Health and Environment (CDPHE). CDPHE completed what was called the Phase II RI in September 1990. The Phase II RI identified and ranked additional sources of contamination to Clear Creek. The Phase II Feasibility Study (FS), which was completed in September 1991, evaluated different options for addressing this contamination. The Phase II ROD, also called the OU3 ROD, was signed on September 30, 1991. For the Argo Tunnel discharge, the decision was made in the OU3 ROD to supersede the OU1 ROD and treat the Argo Tunnel water using a chemical precipitation plant versus the constructed wetland remedy selected in the OU1 ROD. This was because subsequent research had revealed that the constructed wetlands would not likely be effective on discharge rates as great as the Argo Tunnel. Also, in the OU3 ROD, EPA and CDPHE selected the option of pumping contaminated ground water from the mouth of nearby Virginia Canyon and treating it at the Argo Tunnel treatment plant if the ground water could be captured. Initial investigations of the ground-water system in Virginia Canyon indicated that the ground water cannot be easily collected. At this time, Virginia Canyon ground water will not be treated. However, the plant was designed to allow easy expansion, if other ground water collection options can be developed.

In September 1993, CDPHE began designing the Argo Tunnel water treatment plant. Construction of the plant will be completed in December 1997. The treatment is a sodium hydroxide metal precipitation process which produces a high density sludge. The plant was designed with dual train treatment units which together can treat up to 700 gallons per minute of water. During normal flow rates (200 gpm) only one treatment train will be operated.

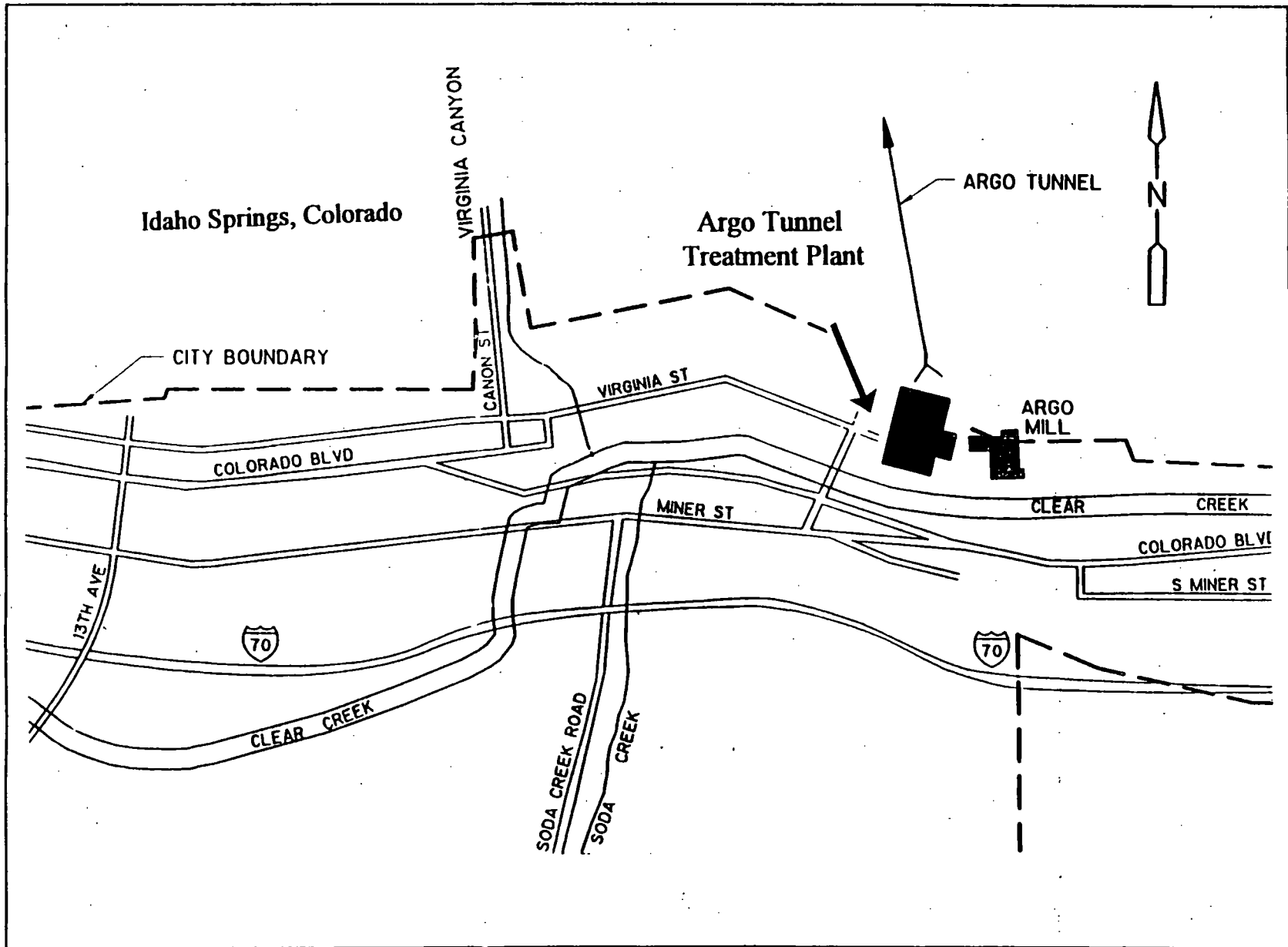


Figure 1. Argo Tunnel Location Map

EPA funded the design of the treatment plant. Plant construction was paid for with 90% EPA Superfund and 10% state funds. This cost sharing arrangement will continue for the first eleven years of plant operation, after which, the operation of the plant will be 100% state funded. EPA acquired the land upon which the treatment plant is constructed through a settlement with the landowner. The settlement is embodied in a Consent Decree dated June, 1997. The State will take title to the land after ten years.

#### Applicable or Relevant and Appropriate Requirements:

The 1986 Superfund Amendments and Reauthorization Act (SARA) adopted and expanded a provision in the 1985 National Contingency Plan (NCP) that remedial actions must at least attain applicable or relevant and appropriate requirements (ARARs). Applicable requirements mean those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a Superfund site. Relevant and appropriate requirements mean those cleanup standards that address problems or situations sufficiently similar to those encountered at the Superfund site that their use is well suited to the particular site. To-Be-Considered information (TBCs) are non-promulgated advisories or guidance issued by Federal or state governments that are not legally binding and do not have the status of potential ARARs. There will be circumstances, however, where TBCs, along with ARARs, are used with best professional judgement in determining the necessary level of cleanup.

Both on-site and off-site direct discharges from Superfund sites to surface waters are required to meet the substantive requirements of the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program. These substantive requirements include discharge limitations (both technology and water quality-based), certain monitoring requirements, and best management practices. These requirements would be contained in an NPDES permit for off-site Superfund discharges. For on-site direct discharges from a Superfund site, these substantive requirements must be identified and complied with even though on-site discharges are not required to have an NPDES permit. EPA guidance suggests that a direct discharge of Superfund waste waters would be "on-site" if the receiving water body is in the area of contamination or is in very close proximity to the site and necessary for the implementation of the response action (even if the water body flows off-site.). The State and EPA have determined that, for the purposes of the Argo Tunnel, the discharge is occurring on-site. This means that treatment of the discharge will not require an NPDES permit. However, all substantive requirements of the NPDES program will be met and documented. This document describes the rationale, requirements and procedures which will need to be achieved by the Argo Tunnel on-site remedial action to demonstrate compliance with ARARs, CERCLA, and the NCP.

#### Argo Tunnel Water Treatment Plant ARARs:

The OU3 ROD established ARARs for the Clear Creek/Central City Superfund Site including the Argo Tunnel water treatment plant. The ARARs that prescribe discharge limits and operational activities are listed below. For most pollutants of concern, there are several overlapping ARARs. There is also additional information pertinent to the setting of the Argo Tunnel discharge limits which are referred to as To-Be-Considered (TBC), additional information which can be used to set remediation goals.

This compliance document identifies potential ARARs and TBC information for each pollutant of concern and analyses the applicability of the potential ARARs following Sections 121(d)(2)(A)(ii) and B(i) of CERCLA. The most applicable ARARs are then used to calculate each pollutant's discharge limits. See the discharge limit calculation section starting on page 20 for a pollutant by pollutant discussion of limits and ARARs. Also, some of the ARARs have changed since the OU3 ROD was signed in 1991 or new information has become available. This document incorporates any necessary revisions to the ARARs.

The discharge limits and other requirements defined in this document apply or implement ARARs specifically to the Argo Tunnel water treatment plant. It should be noted that the Argo Tunnel is not the only source of pollution in Clear Creek. Water Quality Standards and criteria will not be completely achieved in Clear Creek after start-up of the Argo Tunnel water treatment plant because of other sources of pollution impacting the stream (e.g. other mine discharges, tailings piles, road cuts, and other disturbances of mineralized rock).

### Discharge Limits and Requirements ♦ ARARs

#### CERCLA - National Contingency Plan

- 40 CFR 300
  - §300.400 (g) Identification of ARARs
  - §300.430 (g)(3) Use of advisories, criteria
  - §300.430 (f)(1) Inconsistent application of requirements, new or changed requirements
  - §300.435 Compliance with ARARs

#### Federal

#### CWA-NPDES Regulations (surface water discharge permits)

- 40 CFR 122 NPDES permit writing regulations
  - § 122.44 Establishing limitations, pollutants of concern, monitoring
  - § 122.45
- 40 CFR 440 Effluent limitations for active mines and mills
  - §440.104 New source technology based limitations for gold mines.

#### CWA - Water Quality Standards

- 40 CFR 131
- Water Quality Criteria documents such as the 'Gold Book'

#### Safe Drinking Water Act - Drinking Water Standards

- 40 CFR 141 - MCLs

**Discharge Limits ♦ ARARs (continued)****Colorado****Colorado CDPS permit writing regulations****5CCR 1002**

- 61 Permit writing regulations
- 62 State effluent limits

**Colorado - Water Quality Standards****5CCR 1002**

- 31 Basic Standards and Methodologies for Surface Water
- 38 Classification and Numeric Standards for the South Platte Basin. Stream classifications and water quality standards for each segment of Clear Creek.

The State of Colorado's Basic Standards and site-specific water quality standards adopted by the State for Clear Creek are the predominate ARARs for the Argo Tunnel treatment plant discharge. The State has established standards for each segment of Clear Creek and its tributaries. The Argo Tunnel water treatment plant discharges into Segment 11 of Clear Creek. The standards for this segment are based on the following water uses: cold water aquatic life (trout fishery), drinking water, agriculture and recreation. In spite of the high quality trout fishery use designation, it is unlikely that water quality in Clear Creek will ever be clean enough to support the most sensitive aquatic species that might live in Clear Creek (usually rainbow trout) because of existing pollution. For that reason Colorado has modified some of the standards or does not normally apply the standards in mining areas. Stream standards may also change in the future with new information or additional remediation.

With the start up of the Argo Tunnel treatment plant, water quality in Clear Creek will improve, increasing protection of trout and other aquatic life. Fish species which are more tolerant of metals, such as brook and brown trout, have been identified by the Federal and State Superfund programs as the biological goal for Clear Creek in the vicinity of the Argo Tunnel. (It should be noted that fish habitat is also a major factor in protecting fish. There are areas of Clear Creek with impaired fish habitat. Generally, habitat restoration cannot be covered under Superfund by EPA.)

As mentioned above some water quality standards adopted by the State for Clear Creek reflect existing pollution. These modified standards (cadmium, copper and zinc) are not completely protective of aquatic life. For these parameters the discharge limits for the Argo Tunnel water treatment plant will be based the most relevant and appropriate requirement; either the underlying (more stringent) aquatic life standard, a standard based on protecting brown trout, or treatment technology.

The water quality standards of 1991 were established as ARARs for the Argo Tunnel water treatment plant. Since that time, new information has become available on the human health effects of manganese. Colorado has also been modifying manganese standards to reflect in-stream manganese concentrations on several Clear Creek and South Platte stream segments and new information has been developed regarding the toxicity of manganese to aquatic life. See the manganese limit derivation discussion for specifics.

In summary, most Argo Tunnel discharge limits are based on the water quality standards and criteria for aquatic life-trout fishery and drinking water-human health. For zinc the limits are based on protecting brown and brook trout.

For each metal, a discussion of potential chemical-specific ARARs and the subsequent effluent limit derivation is contained in the discharge limitation section of this document. Part II of the document, the discharge control mechanism contains the specific effluent limits and monitoring requirements which have been established for the water treatment plant.

#### Monitoring and Record Keeping Requirements:

The required level of monitoring, record keeping and reporting necessary at Superfund sites is not as well defined as the pollutant specific ARARs. Under Superfund, requirements are separated into "substantive" and "administrative" requirements. Substantive requirements are ARARs that must be attained. Superfund is not required to comply with administrative requirements. Substantive requirements are those that pertain directly to actions or conditions in the environment. Examples include quantitative environmental or health based standards for hazardous substances (e.g., MCLs for drinking water) and technology-based standards (e.g., RCRA minimum technology requirements for double liners and leachate collection systems). Administrative requirements are those mechanisms that facilitate the implementation of the substantive requirements of a statute or regulation, e.g., requirements related to the approval of or consultation with administrative bodies, documentation, permit issuances, reporting, record keeping, and enforcement.

For the Argo Tunnel water treatment plant, EPA and CDPHE have determined that monitoring of parameters with effluent limits are substantive requirements necessary to show that the treatment plant is operating in compliance with ARARs. These parameters and their monitoring frequency are discussed in the last section of this part and specified in the Discharge Control Mechanism. EPA and CDPHE plan on conducting additional monitoring to establish treatment plant efficiency, ensure that influent conditions have not changed significantly, and demonstrate in-stream water quality improvements. This monitoring is a mix of substantive and administrative requirements. Instream monitoring will be substantive if the data is used to evaluate achievement of ARARs in Clear Creek. Monitoring influent conditions will also be substantive when determining the effectiveness of treatment. EPA and CDPHE will also conduct "good neighbor" monitoring of nutrients because Clear Creek watershed members are concerned about nutrient levels in Clear Creek and Standley Lake. This "good neighbor" monitoring is not a substantive requirement.

While record keeping and reporting are typically considered administrative requirements, some level of record keeping and reporting are necessary to demonstrate that the treatment plant is operating in compliance with ARARs. EPA and CDPHE are requiring the contract operator for the Argo Tunnel water treatment plant to maintain records and provide monthly reports to EPA and CDPHE. With this information the two agencies can assess ARARs compliance. The reporting and record keeping requirements are outlined in Section II of the Discharge Control Mechanism.

## **Contacts - Argo Tunnel Treatment Plant ARARs Compliance Document**

**Facility Operator:** Contractor of Colorado Department of Public Health and Environment  
CET Environmental Services, Inc.  
6900 E. 47th Avenue Drive, Suite 200  
Denver, CO 80216  
(303) 331-0062 Fax: (303) 331-9456

**CDPHE Superfund:** Ron Abel/Rick Brown  
Hazardous Materials & Waste Management  
Division (HMWMD-RP-B2)  
Colorado Department of Public Health and Environment  
4300 Cherry Creek Drive South  
Denver, CO 80246-1530  
(303) 692-3381 or 692-3383

**EPA/Superfund:** Dana Allen/Holly Fliniau  
Remedial Project Managers  
U.S. EPA - Region VIII (EPR-EP)  
999 18th Street, Suite 500  
Denver, CO 80202-2466  
(303) 312-6870 or 312-6535

**EPA/Water** Bruce Kent  
NPDES Permit Writer  
U.S. EPA - Region VIII (8P2-W-P)  
999 18th Street, Suite 500  
Denver, CO 80202-2466  
(303) 312-6133

**CDPHE/Water:** Phil Hegeman/Don Holmer (WQCD-P-B2)  
Permits Unit  
Colorado Department of Public Health  
and Environment  
4300 Cherry Creek Drive South  
Denver, CO 80246-1530  
(303) 692-3598 or 693-3601

## Description of Discharge and Monitoring Locations:

Outfall 001 is the outfall from the Argo Tunnel Treatment Plant prior to contact or commingling with any surface or untreated ground water flows. Prior to start up of the treatment plant, Outfall 001 is located immediately below the Argo Tunnel portal. After start up Outfall 001 shall be monitored in the clear well after the treatment units.

Outfall 002 is the by-pass/overflow from the Argo Tunnel Treatment Plant. The Outfall can only be used if flow exceeds 700 gpm, the design capacity of the treatment plant. Small surges (less than 700 gpm) will be treated by starting the second treatment train. The treatment plant also has two holding tanks which can be used for small, short term (less than 1 day) surges. The expected frequency of bypasses is every several years. However, flow surges of greater than 700 gpm have been occurring more frequently in the recent past because of several wet years. Old mine working collapses may also cause surges.

Treatment of blow-out or surges was evaluated in the OU3 ROD, dated September 30, 1991. The analyses determined that treatment of surge events was not warranted. Therefore, no discharge limits apply to discharges through Outfall 002. Monitoring will be required at Outfall 002, see the last section of Part I, ACD, for a discussion of monitoring. The monitoring location is the open channel between the plant intake structure and the by-pass pipe.

Figure 2 illustrates the location of Outfalls 001 and 002 in relation to the treatment plant and Clear Creek. Discharges from the Argo Tunnel are not allowed at any locations other than Outfalls 001 and 002.

## Water Quality Standards and Criteria

The receiving water for the discharge from the Argo Tunnel Treatment Plant is Clear Creek. The Argo discharge is the boundary between segments 2 and 11 of the Clear Creek Basin. Segment 2 begins at I-70 bridge above Silver Plume and extends to the Argo Tunnel discharge. Segment 11 runs from the Argo Tunnel to the Farmers Highline Canal diversion in Golden. Segment 11 is also designated as use protected.

**Numeric Standards:** The standards which have been assigned in accordance with the above classifications can be found in 38, Classifications and Numeric Standards for the South Platte River Basin (5 CCR 1002-38), which became effective August 30, 1997. The following numeric standards which have been assigned in accordance with the above classifications are being used to develop effluent limitations.

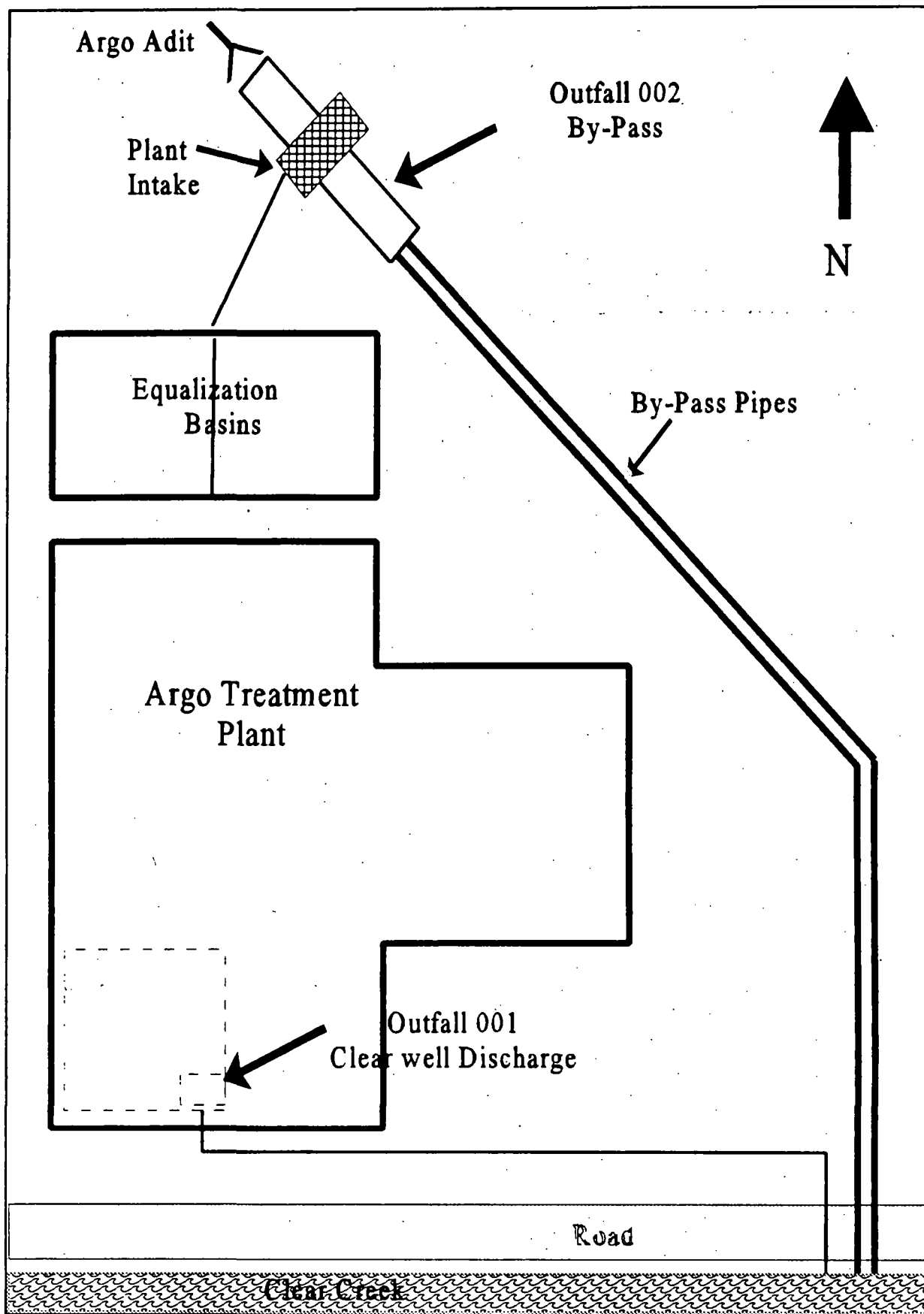


Figure 2: Argo Outfalls and Monitoring Locations

The applicable designated use classifications and standards for Segments 2 and Segment 11 are summarized in Table 1 below:

Detailed water quality standards are listed in Table A-5.

**Table 1: Clear Creek Basin Use Classification and Water Quality Standards**

**Uses:**

**Segment 2\***

(Silver Plume to Argo Tunnel)

Aquatic Life, Class 1 (Cold)

Recreation, Class 1

Agriculture

**Segment 11\***

(Argo Tunnel to Golden)

Aquatic Life, Class 1 (Cold)

Recreation, Class 1

Agriculture

Water Supply

(Use Protected)

**Standards:**

**Segment 2\***

D.O. = 6.0 mg/L, 7.0 mg/L spawning

pH = 6.5 - 9.0

Fecal Coliform Bacteria = 2000/100ml

NH<sub>3</sub> (acute) = TVS

NH<sub>3</sub> (chronic) = 0.02 mg/L (unionized)

Cl<sub>2</sub> (acute/chronic) = 0.019/0.011 mg/L

Chloride = no WQS

Free CN = 0.005 mg/L

S as H<sub>2</sub>S = 0.002 (undissolved)

SO<sub>4</sub> - Sulfate = no WQS

Boron = 0.75 mg/L

Nitrate = no WQS

Nitrite = 0.05 mg/L

Arsenic (acute) = no WQS (dis.)

Arsenic (chronic) = 100 ug/l (TRec)

Cadmium (acute/chronic) = TVS (trout)/TVS

Chromium III(acute/chronic) = TVS/TVS

Chromium VI(acute/chronic) = TVS/TVS

Copper (acute/chronic) = TVS/TVS

Iron (chronic) = 1000 ug/l (TRec)

Iron (chronic) = no WQS (dis)

Lead (acute/chronic) = TVS/TVS

Manganese (chronic) = 1000 ug/l (TRec)

Manganese (chronic) = no WQS (dis)

Mercury (chronic) = 0.01 ug/L (Total)

Nickel (acute/chronic) = TVS/TVS

Selenium (acute/chronic) = TVS/TVS

Silver (acute/chronic) = TVS/TVS(trout)\*\*

Zinc (acute/chronic) = TVS/200 ug/L (TRec)

**Segment 11\***

Same as 2

Same as 2

200/100 ml

Same as 2

Same as 2

Same as 2

250 mg/L

Same as 2

Same as 2

250 mg/L

Same as 2

10 mg/L

Same as 2

50 ug/L(TRec)

no chronic

no acute /3 ug/L(TRec) chronic

50 ug/L(TRec)/no chronic

Same as 2

no acute /17 ug/L(TRec) chronic

Same as 2

300 ug/L(dis)

Same as 2

Same as 2

50 ug/L (dis)

Same as 2

Same as 2

no acute /10 ug/L(TRec)

Same as 2

no acute /300 ug/L (TRec)

Other applicable Colorado (Basic Standards and Methodologies for Surface Water 31.16, 5 CCR 1002-31), and EPA water quality criteria are summarized below: See Table A-5 for more information about standards or criteria. Water quality criteria or other standards may be applicable or potentially relevant appropriate.

**Table 2: Other Colorado and EPA Water Quality Criteria**

Aluminum (acute/chronic)	750/87 µg/L (dis)
Antimony (water supply)	6.0 µg/L (TRec) 30-day
Antimony (water + fish)	6.0 µg/L (TRec)
Arsenic (acute/chronic)	360/150 µg/L (dis)
Arsenic (ag)	100 µg/L (TRec) 30-day
Arsenic (water supply)	50 µg/L (TRec) 1-day
Barium (water supply)	1000 µg/L (TRec) 1-day
Beryllium (ag)	100 µg/L (TRec) 30-day
Beryllium (water supply)	4.0 µg/L (TRec) 30-day
Cadmium (ag)	10 µg/L (TRec) 30-day
Cadmium (water supply)	5 µg/L (TRec) 1-day
Chromium III (ag)	100 µg/L (TRec) 30-day
Chromium III (water supply)	50 µg/L (TRec) 1-day
Chromium VI (ag)	100 µg/L (TRec) 30-day
Chromium VI (water supply)	50 µg/L (TRec) 1-day
Chromium VI (acute/chronic)	16/11 µg/L (dis)
Copper (ag)	200 µg/L (TRec)
Copper (water supply)	1000 µg/L (TRec) 30-day
Fluoride (water supply)	2.0 mg/l (TRec) 1-day
Lead (ag)	100 µg/L (TRec) 30-day
Lead (water supply)	50 µg/L (TRec) 1-day
Manganese (water supply)	50 µg/L (dis) 30-day
Mercury (acute/chronic)	2.4/0.1 µg/L (dis)
Mercury (water supply)	2.0 µg/L (TRec) 1-day
Nickel (ag)	200 µg/L (TRec) 30-day
Nickel (water supply)	100 µg/L (TRec) 30-day
Selenium (acute/chronic)	20/5 µg/L (dis)
Selenium (ag)	20 µg/L (TRec) 30-day
Selenium (water supply)	50 µg/L (TRec) 30-day
Silver (water supply)	100 µg/L (TRec) 1-day
Thallium (chronic)	15 µg/L (dis)
Thallium (water supply)	0.5 µg/L (TRec) 30-day
Thallium (water + fish)	0.5 µg/L (TRec)
Uranium (acute/chronic)	TVS/TVS (dis)
Zinc (ag)	2000 µg/L (TRec) 30-day
Zinc (water supply)	5000 µg/L (TRec) 30-day

Footnotes

TVS - Table Value Standard; numerical criteria set forth in Table III from the State of Colorado's Basic Standards and Methodologies for Surface Water, 31.16 (5 CCR 1002-31). TVS are calculated for each metal based on stream hardness. The calculated TVS are shown in Table A-5

ch - chronic

ac - acute

ag - agriculture

TRec - Total Recoverable

dis - dissolved

\* From "Classification and Numeric Standards, South Platte River Basin", as amended August 30, 1997.

\*\* Silver (chronic) effective 3/2/98

## Identifying Pollutants of Concern, Parameters Needing Limits and/or Monitoring:

All available data on the Argo Tunnel discharge were reviewed to determine the toxic pollutants present in the effluent at levels of concern or "trigger level". Limits will be developed for pollutants with concentrations which may potentially exceed water quality standards or cause toxic effects (trigger levels). Pollutants with concentrations below trigger levels but with limited or old data will be monitored for the first year to confirm actual pollutant levels. Pollutants at concentrations below toxic levels and with adequate data will not be considered further for limits or monitoring. This review was conducted by comparing the discharge analytical data to the more stringent value from State water quality standards, Federal water quality criteria and proposed or final drinking water standards (MCLs).

The Argo Tunnel discharge and Clear Creek have been sampled on several occasions by the USGS, EPA, the Colorado Department of Public Health and Environment, the Upper Clear Creek Watershed Association and as part of Superfund remedial investigations. Table A-1 in Appendix A presents a compilation of tunnel discharge sampling and analysis results reported in the above studies and reports. Tables A-2 and A-3 present summarized results of monitoring conducted in Clear Creek.

Because analytical data for the Argo Tunnel discharge are limited and the discharge may vary in chemical composition on a seasonal basis, all data was considered in determining if a limit is needed for toxics present in the discharge. This limited data allowed only a semi-quantitative comparison. For example, analytical techniques (total, total recoverable, and dissolved) used for analyzing the Argo Tunnel discharge and Clear Creek samples differ from the published Federal water quality criteria and State water quality standards. For example, the WQS may be in dissolved form and the water quality data may be in total. The two forms are similar but not directly comparable. Also, different levels of detection were used, and some detection limits reported were too high to accurately compare actual discharge pollutant concentrations with State water quality criteria and/or EPA "Gold Book" values. Therefore, a direct quantitative comparison of the Argo Tunnel discharge and Clear Creek analytical results to the criteria and standards was not possible. For example, we may have a parameter with a WQS of 0.1, but the tests only measured to 0.5. For this data, we cannot tell if the WQS is being met. As stated previously, the determination of parameters in need of a limit was made on a conservative basis. Table A-1 is the result of the data review. The second to the last column in Table A-1 indicates whether the parameter will be analyzed further for a limit or if more monitoring is needed to ensure that in-stream water quality standards are not exceeded.

No actual data was available to evaluate the pollutant concentrations in the Argo discharge after treatment. Information from bench tests and treatability studies were evaluated when projecting possible effluent concentrations. Historical data on the untreated Argo discharge was used for projecting the need for effluent limits based on water quality standards.

### Pollutants of Concern, Parameters Needing Effluent Limits and/or Monitoring:

After evaluating the data to identify parameters that need effluent limitations and/or monitoring, the pollutants were grouped into four groups: (1) Pollutants expected to be present and have potential to exceed instream water quality standards or other trigger levels [Effluent Limits and Monitoring]; (2) Pollutants at very low concentrations which historically never exceeded water quality standards and are very unlikely to in the future [No Effluent Limits, No Monitoring]; (3) Pollutants which are at generally low levels, have inadequate data, or are expected to be present below levels of concern after treatment [First year Influent and/or Effluent Monitoring, No Effluent Limits]; and lastly, (4) Pollutants which are not expected to be of concern at the Argo Tunnel, but are important for evaluating any changes in the influent to the Argo Tunnel or may be important to other users of Clear Creek water [Monitoring Only]. The following paragraphs describe the conclusions of identifying pollutants of concern at the Argo Tunnel. Instream monitoring will also be required for group 1, 3 and 4 pollutants. See the last section of part 1 regarding monitoring.

#### Group 1: Pollutants of Concern - Limits and Monitoring

Discharge limitations and monitoring for Group 1 Pollutants will be analyzed further in the next sections of this document, starting on page 20 "Calculation Of Discharge Limits". Group 1 Pollutants are: aluminum, arsenic, beryllium cadmium, copper, iron, lead, manganese, nickel, silver, zinc, flow, whole effluent toxicity, pH, fluoride, sulfate, total suspended solids (TSS), and oil and grease (O&G) as set forth in the section. These pollutants are expected to be present and have potential to exceed instream water quality standards or trigger levels.

#### Group 2: Pollutants - No Limits, No Monitoring

Antimony, barium and molybdenum were the only monitored parameters which never exceeded a "Gold Book" value or a State water quality criterion. For example, both total and dissolved antimony maximum concentrations are less than 10 percent of "Gold Book" criteria for chronic aquatic life. Barium, has never been detected in the Argo discharge. Also, there are no published "Gold Book" criteria or State water quality criterion for cobalt, strontium, tin, and vanadium, and hence, no basis for establishing a water quality effluent limit or monitoring. Therefore, no limits or monitoring will be required for antimony, barium, cobalt, molybdenum, strontium, tin, and vanadium.

Total Dissolved Solids (TDS) were found in relatively high concentrations in the Argo Tunnel discharge. A limit and monitoring was not evaluated further for dissolved solids because the ions of concern that make up TDS will have individual effluent limitations and/or monitoring. Therefore, there is no need for a separate TDS limit or monitoring.

The untreated and treated discharge from the Argo tunnel is primarily comprised of metal cations and anions, and therefore is expected to contain little or no organic matter and should exhibit little or no oxygen demand on the receiving water. Thus, there will be no limits or monitoring requirements for biochemical oxygen demand (BOD), chemical oxygen demand (COD), or total organic carbon (TOC); or for dissolved oxygen (D.O.). In addition, no sanitary wastewater enters in the discharge, therefore no fecal coliform limits or monitoring will be required.

### Group 3: Pollutants of Concern - First Year Monitoring Only

Several metals specifically, mercury, selenium, and thallium, were found in the untreated Argo Tunnel discharge at or around the analytical detection limit. In evaluating the downstream water quality in Clear Creek, it appears that none of these metals are in significant concentrations to have the potential to exceed instream water quality standards. However, because of elevated analytical detection limits and the lack of recent data for selenium, thallium, and mercury, limits will not be required for these pollutants. Influent and effluent monitoring will be required during the first year to determine if mercury, selenium, and thallium are present at levels of concern. The treatment plant is expected to further reduce the concentration of these metals in the discharge.

Another set of pollutants that will have no initial limits but will be monitored are ammonia-N, radium, uranium and gross alpha. There has been little or no information collected on the concentrations of these pollutants in the Argo discharge, and therefore, the pollutants will be monitored in the treatment system influent and effluent to determine if these constituents are of concern.

An additional set of pollutants which shall not have limits but will require monitoring is chromium, and hexavalent chromium. These pollutants have been monitored in the Argo discharge and have been detected at levels generally below applicable water quality criteria; however, several samples approached or exceeded criteria. Since the treatment system may remove these pollutants, monitoring will only be required for the first year to determine if the level of these pollutants in the treated discharge are at levels of concern.

### Group 4: Pollutants of Concern - Watershed or Indicator Parameters, Monitoring Only

Total phosphorous will be monitored during the first year to provide data to the Upper Clear Creek Watershed Association and Standley Lake Users regarding the quantity of phosphorous being discharged into Clear Creek and Standley Lake.

Nitrate/nitrite levels will be monitored to establish current levels of these compounds in the Argo influent and discharge. Cyanide will also be monitored on the influent to determine the presence of cyanide in the discharge before treatment. Influent cyanide and nitrate/nitrite may be monitored throughout the life of the control mechanism because they are prime indicators of active mining influencing historic water quality. The Argo Tunnel has at least one cyanide heap leach facility above it. This facility has considered discharging surplus wastewater into old mine workings. Other cyanide based gold mining/beneficiation activities in areas that may drain into the Argo Tunnel may be also developed in the future. Increased concentrations of nitrate and/or nitrite may also indicate wastewater discharges from active mining in the area. Nitrate is a by-product of active blasting. A baseline for cyanide, nitrate, and nitrite must be established so that any changes in the discharge quality due to new mining can be documented. Nitrogen forms are also of concern to the Standley Lake users. Monitoring will be conducted for these parameters on the influent, effluent and/or instream.

For cyanide, the standard for the receiving stream is based upon "free" cyanide concentrations. However, there is no analytical procedure for measuring the concentration of free cyanide in a complex effluent. Therefore, ASTM (American Society for Testing and Materials) analytical procedure D2036-81, Method C, will be used to measure weak acid dissociable cyanide in the effluent. This analytical procedure will detect free cyanide plus those forms of complex cyanide that are most readily converted to free cyanide.

Hardness of the discharge will also be monitored, but will not have a limit. Flow limits will be discussed later. If mass loading limits for specific pollutants are later developed, they will be established using current and historical flow and pollutant concentration data. Flow and hardness are also necessary to be monitored to fully understand the effect of pollutant loadings in Clear Creek and to ensure that excursions of instream water quality standards are not allowed by the control mechanism. Instream monitoring of flow and hardness in Clear Creek will also be monitored to collect information to evaluate the effectiveness of the remedial action, reevaluate limits and reopen the control mechanism as necessary.

Although none of the Group 4 pollutants are expected to be present at significant levels, the control mechanism can be reopened and limits and continuous monitoring added if they are found at levels of concern.

## Determining Effluent Limitations

There are three main types of effluent or discharge limitations. Limits are usually based on: (1) water quality standards and criteria, (2) treatment technology performance, or (3) state effluent standards. During the time when this discharge control mechanisms was being developed, the treatment system was not in operation. Therefore, no treated effluent was available for analysis. Without any chemical analyses of the effluent, it is not possible to precisely determine which pollutants will need technology based effluent limits. Consequently, for this initial control mechanism, limits are almost exclusively based on water quality standards and criteria.

## Interim Effluent Limitations

There are two sets of interim limits. Initially, during construction and the first months of start-up, the existing water quality from the Argo Tunnel shall be maintained to the maximum extent possible. Expected practices include minimizing the resuspension of sediment and metal precipitants. The second set of interim limits starts 90 days after the treatment plant begins operating. These interim effluent limitations are shown in Table A-8 and are based upon Best Professional Judgment using New Source Performance Standards (NSPS) for Ore Mining and Dressing Point Source Category; Lead, Copper, Zinc Gold, Silver and Molybdenum Ores (40 CFR Part 440 Subpart J; 440.104). Although the NSPS are not directly applicable to historic mine drainage, the NSPS represent levels achievable by simple metals precipitation. The NSPS limit for mercury has not been included because mercury was rarely detected in the untreated Argo drainage. An additional limit for oil and grease, based on State of Colorado Effluent Standards, is included in the interim standards. The pH limit is based on Colorado Water Quality Standards. The interim limits are presented in tabular form as Table A-4.

## Final Effluent Limitations

Final effluent limitations and monitoring frequencies are presented in Table A-10. They become effective October 1, 1998. This date is based on nine months start-up for the treatment plant. Final effluent limitations and monitoring requirements are derived from the State of Colorado's Water Quality Standards, National Ambient Water Quality Criteria ("Gold Book" values), the State of Colorado's Effluent Standards and Best Professional Judgement. In addition, selected parameters were evaluated using EPA's Metals Translator, which converts effluent limits based on dissolved water quality standards to Total Recoverable effluent limits. The effluent limitations for this control mechanism have been developed to control all pollutant parameters which are or may be discharged from the Argo Tunnel at a level which will cause, have the reasonable potential to cause or contribute to, an excursion above a State water quality standard including the State narrative criteria for water quality or National Ambient Water Quality Criteria.

## CALCULATION OF DISCHARGE LIMITS

### Group 1 - Pollutants with Final Limits and Monitoring:

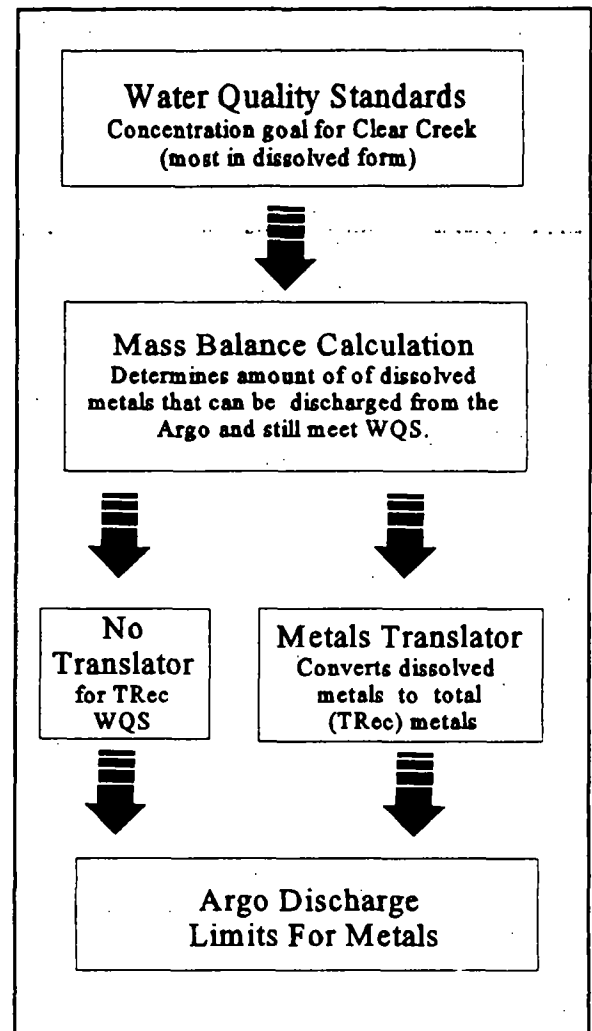
Discharge limitations and monitoring have been developed for the following metals: arsenic, cadmium, copper, iron, lead, manganese, nickel, silver and zinc. In addition, limits and monitoring have been developed for whole effluent toxicity, pH, total suspended solids (TSS), and oil and grease (O&G).

Water quality standard (WQS) based limitations were generally developed following the diagram to the right. Depending on the mass balance calculation, WQS limits either include no allowance for dilution due to high pollutant background concentrations in Clear Creek upstream of the discharge, or the limits were based on a simple mass balance allowing for dilution to ensure instream water quality standards are met (waste load allocation). For pollutants which already exceed the WQS upstream of the Argo, there are no mass balance or dilution allowances. The treatment plant limit is based on meeting the WQS at the end of the pipe. As the waste load allocations and standards are refined for Clear Creek, the control mechanism may be reopened to incorporate revised concentration or mass based water quality based limits.

### Mass Balance Calculation:

The mass balance calculations are based on the low flow rates for Clear Creek, the Argo discharge flow rate (design capacity), the concentration of pollutants in Clear Creek upstream of the Argo Treatment Plant and water quality standards. The simple mass balance equation is below.

Flow values corresponding to 1E3<sup>1</sup> and 30E3<sup>1</sup> conditions of Clear Creek near the treatment plant (from rationale [September 1996] for Idaho Springs permit) are summarized on the next page:



<sup>1</sup> Acute low flow: 1E3 = lowest flow for one day occurring on average every three years  
Chronic low flow: 30E3 = lowest flow for 30 consecutive days (monthly), occurring on average every three years.

*Acute and Chronic Low Flows, Clear Creek, Idaho Springs*

	<i>Annual</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>
<i>Acute</i>	29	29	29	36	39	64	124	124	77	59	46	33	33
<i>Chronic</i>	34	39	39	39	39	59	172	102	70	62	46	41	34

Many of the metals water quality standards are based on hardness. A low flow hardness of 50 mg/L was used in the calculation of effluent limitations (for Cd, Cu, Ni, Pb, Ag and Zn) based on aquatic life criteria which vary with hardness. This value is a close estimate of hardness of Clear Creek at high flow conditions. There is no actual data available to determine the hardness range in Clear Creek once the Argo Treatment plant is operating. The limits for these parameters should be revised or reevaluated when actual instream hardness data is developed after the treatment system is fully operational. The future treatment plant may also add some hardness to the receiving water.

A mass balance equation was used to determine the effluent concentrations that would not violate the allowable in-stream concentrations defined by the WQ standards (except in the case of pH, where the limits are set directly from stream standards or effluent regulations without using a mass balance approach). The mass balance equation is:

$$M_2 = \frac{M_3 Q_3 - M_1 Q_1}{Q_2}$$

Where:

$Q_1$	=	Upstream low flow (1E3 or 30E3)
$Q_2$	=	Average daily effluent flow (design capacity)
$Q_3$	=	Combined downstream flow ( $Q_1 + Q_2$ )
$M_1$	=	Upstream background pollutant concentration
$M_2$	=	Unknown; Maximum allowable effluent pollutant concentration calculated using mass balance equation
$M_3$	=	Maximum downstream allowable pollutant concentration (stream standard)

*The following flows were used in the mass balance equation:*

Flow	Acute (1E3)	Chronic (30E3)
$Q_1$	29 cfs	34 cfs
$Q_2$	1.56 cfs	1.56 cfs
$Q_3$	30.56 cfs	35.56 cfs

Because of the mathematical relationship between flow, pollutant concentration and pollutant mass, concentration limitations for the Argo Treatment Plant calculated using this method implicitly limit instream pollutant mass to a maximum allowable level. Calculations assumed a design flow of the Argo treatment system of 700 gpm. The plant will normally operate around 200 gpm. Upstream data collected at monitoring location SW-07 (Clear Creek below Chicago Creek) was used for background pollutant concentrations upstream. Stream standards for Segment 11 were applied as downstream maximums. A summary of potentially applicable stream standards is presented as Table A-5. A summary of the mass balance calculations are shown in Table A-6.

For several metals (cadmium, copper, manganese and zinc) mass balance calculations were not possible because upstream water quality already exceeds water quality standards. As pointed out previously, the Argo Tunnel is one of many sources of pollution in Clear Creek. Even if the Argo Treatment Plant could remove 100% of the metals in the tunnel discharge, water quality standards would still not be achieved because of other pollution sources. The Argo Treatment Plant will be removing 98% to 99.7% of the pollutants of concern.

#### Metals Translator:

Most of the metal water quality standards are in dissolved form. The analytical methods that will be used to monitor effluent quality are for total recoverable metals. The metals translator converts the dissolved limit to a total recoverable (TRec) limit. The EPA's Metals Translator converts dissolved effluent limits into a total recoverable effluent limits through use of downstream ratios of dissolved and total recoverable metals. For this evaluation, instream data collected from 1994 - 1997 at sample location CC-40 (Clear Creek below Idaho Springs WWTP) will be used. It is assumed that the ratios of dissolved and total metals in the Argo discharge and the stream will be approaching or at equilibrium at this location, and influence by other point and nonpoint sources is minimal. The metals translator analysis is presented as Table A-7. The metals translator is not applied to WQS already in TRec form. The metals translator is also not applied to pollutants where there was not enough data to calculate a metals translator. In those cases, the dissolved limit will be monitored by total recoverable methods.

A comparison of potential limits based on water quality standards in the dissolved and total recoverable form (TRec)[Table A-5] and calculated metals translator values is shown in Table A-8. The lowest value from either the translator and/or the mass balance equation will be used as the basis for the effluent limit.

#### Discharge Limits For Specific Parameters:

##### **ALUMINUM**

The Argo Tunnel effluent data showed that aluminum concentrations average around 30,000 µg/L (See Appendix Table A-1). All samples analyzed for total or dissolved aluminum had concentrations exceeding "Gold Book" values and State criteria. The ARARs that were considered in setting limits are: 750 µg/L acute and 87 µg/L chronic Colorado basic water quality standards. However, these aluminum standards have not been specifically applied to this segment of Clear Creek and are

therefore not a legally applicable ARAR. For many stream segments with historic mining pollution, the State has not applied the 750 and 87  $\mu\text{g/L}$  standards. When specific standards has not been established, an indicator limit can be developed such as WET.

Whole effluent toxicity have been used previously to control toxicity from aluminum in a similar mining discharge on Clear Creek. Therefore, no aluminum discharge limits have been included in the control mechanism. Instead, the toxic effects of aluminum will be controlled through a whole effluent toxicity (WET) limit of "no acute toxicity". Later a technology based limit may be developed for aluminum. A technology based limit could not be developed at this time because there is no performance data yet and the amphoteric nature of aluminum chemistry. (Aluminum dissolves at both high and low pHs.) Monitoring for aluminum will be required.

ALUMINUM	CHRONIC CRITERIA	ARAR <sup>1</sup>	ACUTE CRITERIA	ARAR <sup>1</sup>
SOURCE OF CRITERIA <sup>2</sup>				
Basic TVS	87 µg/L	Rel.	750 µg/L	Rel.
Old State Basic Standard, in ROD	150	Rel.	950	Rel.
Current WQS applied by CO WQCC to Segment 11	No criteria	L.Appl.	No criteria	L.Appl.
NPDES Regs. 122.44(d)(vi)	Use Surrogate	R&A	Use Surrogate	R&A
WQS - No Toxins in Toxic Amounts	No Toxicity	L.Appl.	No Toxicity	L.Appl.
FINAL DISCHARGE LIMITS AND MONITORING FOR ALUMINUM				
Chronic - No chronic limit		Acute Limit: No acute toxicity		
Monitoring - Acute Whole Effluent Toxicity tests (WET), quarterly.				

<sup>1</sup> ARAR - This column denotes the potential ARAR status of each criteria.

L.Appl. = legally applicable;

Rel. = relevant

R&A = relevant and appropriate;

TBC = to be considered information.

<sup>2</sup> WQS - Water Quality Standard in Segment 11 of Clear Creek.

NPDES Regs - Federal Regulations for Surface Water Permits, 40 CFR 122.

TVS CO - Table value standard, part of Colorado WQS

CO WQCC - Colorado Water Quality Control Commission. Appointed commission which decides Colorado's WQS, and the regulations to apply standards.

MCL - Maximum contaminant level, drinking water standards

BPJ - Best Professional Judgement per NPDES Regs.

CO - DOW - Colorado Division of Wildlife

**ARSENIC**

A maximum limit of 400 µg/L for total recoverable arsenic is included in the control mechanism based on the State of Colorado MCL- water quality standard of 50 µg/L arsenic. Total arsenic measured in the Argo Tunnel discharge range from 35 - 238 µg/L. This limit is more stringent than other limits derived for aquatic life (acute and chronic). Therefore, only an acute, MCL based limit will be applied.

ARSENIC	CHRONIC CRITERIA	ARAR	ACUTE CRITERIA	ARAR
SOURCE OF CRITERIA				
WQS - Drinking Water MCL	---	L.Appl.	50 µg/L TRec	L.Appl.
WQS - Aquatic Life TVS	150 Dis	L.Appl.	360 Dis	L.Appl.
FINAL DISCHARGE LIMITS AND MONITORING FOR ARSENIC				
Chronic - No limit		Acute - maximum limit based on: 50 µg/L WQS and mass balance calculation = 400 µg/L		
Monitoring - Weekly, TRec				

**CADMIUM**

Both total and dissolved cadmium concentrations in the Argo Tunnel effluent exceeded State water quality standards (WQS) and "Gold Book" criteria. The average dissolved cadmium concentration calculated from discharge data ranges from 122 - 540 µg/L, which is well in excess of "Gold Book" criteria. Instream concentrations also appear to exceed the State WQS and criteria; however, the detection limits were above the WQS. The analytical detection limit for cadmium for the existing data range from 14 to 25 µg/L, the water quality criteria range from 0.66 to 3 µg/L, less than the detection limits. From other data downstream with better detection limits, cadmium ranges from 0.5 to 5.8 µg/L, exceeding on average the cadmium water quality criteria.

A "site specific" water quality standard of 3 µg/l has been established by the Colorado WQCC for cadmium. The site specific WQS takes into account some of the existing pollution in Clear Creek. The 3 µg/l is a prediction of ambient water quality after some clean-up of cadmium sources. Site specific standards are established for stream segments such as Clear Creek where there is historic pollution and it is unlikely that water quality can ever be cleaned up to meet the basic TVS (0.66 chronic and 1.8 µg/l acute). As clean up progresses, a revised site specific water quality standard may be established, based on water quality or protecting a specific biological community (i.e. brown trout and its food sources). The discharge limits may be revised if a new standard is established. Other difficulties in establishing cadmium discharge limits are a lack of data immediately upstream of the Argo Tunnel and the low analytical detection limit needed for cadmium. Most of the upstream data is from just below Chicago Creek which does not include pollution from Virginia Canyon. The poor detection limit for cadmium makes the data unreliable, possibly creating false highs.

To resolve these informational impediments, we have developed a chronic discharge limit of 3 µg/l based on applying the existing water quality standard without using the mass balance calculations. This limit is substantially more restrictive than applying the legally applicable WQS, which calculates to a 36 µg/l cadmium limit. The limit of 3 µg/L is also protective of brown and brook trout.

Monitoring of TRec cadmium will be required on a weekly basis. Upstream and downstream monitoring of Clear Creek will also be required at appropriate detection limits.

CADMIUM (µg/L)	CHRONIC CRITERIA	CHRONIC DISCHARGE LIMIT	ARAR	ACUTE CRITERIA	ACUTE DISCHARGE LIMIT	ARAR
SOURCE OF CRITERIA						
TVS - trout, hardness based (Seg. 2 also)	0.66 Dis	5.3 TRec	Rel.	1.8 Dis	2.4 <sup>3</sup> Trec	Rel.
WQS - site specific (Seg. 11)	3 TRec	36 TRec	L.Appl.	---		
WQS - site specific, no mass balance calculation, BPJ	3 TRec	3 TRec	TBC	---		
MCL - drinking water	---			5.0 TRec	Aquatic life more restrictive	L.Appl.
CO - DOW Trout Criteria: <sup>5</sup> Rainbow Brown Brook	0.7-1.5 DIS 2.0 <sup>4</sup> 1.7-3.4	5.1-23 34.7 27.9-66.6	TBC	3 DIS 1.4 3.6-60.		TBC
FINAL DISCHARGE LIMITS AND MONITORING FOR CADMIUM						
Chronic - monthly average limit based on: 3 µg/L WQS directly applied to discharge without mass balance calculations = 3 µg/L.				Acute - No limit		
Monitoring - Weekly, TRec						

<sup>3</sup> The acute TVS limit was not included because there is no legally applicable WQS, and the mass balance was greatly affected by the limited data set.

<sup>4</sup> Acclimated Trout

<sup>5</sup> Lehnertz, Christine; Colorado Division of Wildlife; *Clear Creek Basins--The Effects of Mining on Water Quality and the Aquatic Ecosystem*; March 1991.

## COPPER

Both total and dissolved copper concentrations in the Argo Tunnel effluent exceeded state water standards and "Gold Book" criteria. The average dissolved copper concentrations from the Argo Tunnel sampling results ranged from 4300 to 6720 µg/L. The average total copper concentrations ranged from 4100 to 13000 µg/L. As discussed above in the cadmium section, a site specific water quality standard for copper has been established for segment 11 of Clear Creek of 17 µg/l, chronic. We have applied the site specific chronic copper standard directly to the Argo discharge, as with cadmium, because of concerns about upstream data quality and to provide increased protection of aquatic life. The acute limit of 35 µg/L Cu is based on the TVS. Weekly monitoring of TRec copper will be required.

[illegible]

## IRON

Iron is present in the Argo Tunnel effluent in concentrations substantially above the State standards and "Gold Book" criteria. Therefore, limits and monitoring for iron is included in this control mechanism. The average dissolved iron concentrations from the Argo Tunnel discharge data ranged from 97 to 204 mg/L (97,000-204,000 µg/L) and the average total iron concentration ranged from 100 to 328 mg/L. The monthly average limit for total recoverable iron is 15,800 µg/L, based on the aquatic life TVS (1,000 TRec) standard for Segment 11 and allowance for dilution. The limit based on the secondary MCL of 300 µg/L dissolved, was not included because it is less restrictive than when converted to a total recoverable limit (245,000 µg/L TRec limit). At a later date, a technology based limit may be developed for iron.

IRON (µg/L)	CHRONIC CRITERIA	ARAR	ACUTE CRITERIA	ARAR
SOURCE OF CRITERIA				
WQS - TVS	1,000 TRec	L.Appl.	---	
WQS-Secondary MCL <sup>6</sup>	300 Dis	L.Appl.	---	
FINAL DISCHARGE LIMITS AND MONITORING FOR IRON				
Chronic - monthly average limit based on: mass balance and 1,000 TVS = 15,800 µg/L		Acute - no limit		
Monitoring - weekly, TRec Fe				

## LEAD

Elevated levels of total and dissolved lead are present in the Argo Tunnel effluent. Results of the effluent sampling (see Table A-1) show that these concentrations have exceeded State WQS and "Gold Book" aquatic life criteria for lead. Therefore monthly average and maximum limits have been included in this control mechanism. The monthly average is 4.75 µg/L total recoverable lead. A maximum limit of 905 µg/L total recoverable lead is also included based on acute TVS.

LEAD	CHRONIC CRITERIA	ARAR	ACUTE CRITERIA	ARAR
SOURCE OF CRITERIA				
WQS-TV5 hardness based	1.5 µg/L	L.Appl.	31.3 µg/L	L.Appl.
Old MCL in ROD			50	L.Appl.

<sup>6</sup> Secondary MCLS - Standards for drinking water aesthetics. Iron and manganese can discolor water, stain laundry or plumbing fixtures, or affect the taste of water.

FINAL DISCHARGE LIMITS AND MONITORING FOR LEAD	
Chronic - monthly average limit based on: TVS, mass balance & metals translator = 4.75 µg/L	Acute - maximum limit based on: MCL, & mass balance = 905 µg/L
Monitoring - weekly, TRec Pb	

## MANGANESE

High concentrations of both total and dissolved manganese are present in the Argo Tunnel effluent. The average dissolved concentrations are calculated from the Argo Tunnel effluent data ranged from 73 to 149 mg/L. The average total concentrations ranged from 74 to 140 mg/L. From this data it is apparent that a manganese limit is needed. However, as listed below, there is a wide range of potential manganese ARARs and other information to consider in setting limits.

MANGANESE (µg/L)	CHRONIC CRITERIA	ARAR	ACUTE CRIT.	ARAR
SOURCE OF CRITERIA				
WQS - Secondary MCL <sup>6</sup>	50 Dis	L.Appl.	--	
Secondary MCL <sup>6</sup>	50 Dis	Rel.	--	
Site Specific WQS, Seg. 14, Golden <sup>7</sup>	500 Dis	Rel.	--	
Technology Based Limit	No data yet	L.Appl.		
Human Health Protection Recommendation	800 TRec	TBC	--	
Aquatic Life TVS	1000 TRec	L.Appl.	--	
Temporary Modification of Segment 14 <sup>7</sup> standard, in effect until 6-30-2000	1200 Dis	Rel.	--	
Hardness Based, Site Specific Standard for Segment 5, West Fork of Clear Creek	5000 Dis	Rel.	--	
TMDL <sup>8</sup> for Manganese	to be determined	L.Appl.	--	

<sup>7</sup> Clear Creek Segment 14 is from the Farmers Highline Canal diversion and Youngfield.

<sup>8</sup> TMDL-Total Maximum Daily Load is the mass (lbs/day) of manganese that should enter Clear Creek. Major sources of manganese will be allocated a portion of the TMDL, called a waste load allocation (WLA).

From our analysis, we identified the 800 µg/L recommendation as the most appropriate criteria to use in setting limits at this time. The 800 µg/L concentration is the chronic manganese level recommended by EPA's drinking water toxicologist to protect human health. The recommendation converts directly into the discharge limit as there is no dilution and the recommendation is in TRec form. The manganese discharge limit is likely to change in the next several years for any one of the following reasons: a Total Maximum Daily Load is calculated for Clear Creek, sufficient data is available for a technology based limit, the 50 µg/L WQS is changed to an ambient standard or other new information becomes available.

FINAL DISCHARGE LIMITS AND MONITORING FOR MANGANESE	
Chronic - <b>monthly average</b> limit based on: human health protection recommendation = 800 µg/L.	Acute - no limit
Monitoring - weekly, Mn TRec	

The most restrictive limit based on the 50 µg/L standard was not included for several reasons:

(1) The 50 standard is not typically applied to stream segments in areas with high background manganese concentrations. For example, on Clear Creek the dissolved manganese WQS on segment 14 has just been changed from 50 to 1200 µg/L until the year 2000 and 500 µg/L thereafter. The 1,000 µg/L TRec manganese standard was also dropped from Segment 14. The 50 µg/L standard on the South Platte between Littleton and Denver and then below Denver have been changed to 190 and 400 µg/L, respectively. (2) The 50 µg/L standard is not based on protecting human health or the environment. The number is based on drinking water system aesthetics. At concentrations above 50 µg/L, manganese may cause a brown/yellow water color or stain laundry or plumbing fixtures. (3) The secondary MCL of 50 µg/L dissolved manganese will be achieved in drinking water supplies. Most municipalities treat drinking water to remove manganese. (4) The treatment process will not be as efficient for zinc and aluminum removal if the treatment plant is operated to reduce manganese to 50 µg/L. The plant will operate better at moderate manganese discharge limits. It should be noted that at the 800 µg/L limit, the plant will be removing over 99% of the manganese from the Argo Tunnel discharge. Untreated, the Argo discharges an average of 102,000 µg/L manganese.

The 50 µg/L standard is a legally applicable ARAR. However, EPA and CDPHE have decided to waive the ARAR using the waiver provisions of CERCLA at Section 121(d)(2)(4).

**NICKEL**

Dissolved nickel has been detected in the Argo Tunnel discharge between 187 and 628 µg/L. These concentrations exceed the State water quality criteria for dissolved nickel. A monthly average limit of 850 µg/L is included based on the TVS and allowance for dilution. The dissolved limit will be directly applied as a TRec limit because detection limits in the data did not allow a metals translator to be calculated. Since the calculated acute limit (10,305 µg/L) is much greater than the levels that will occur in the discharge, only the chronic limit will apply.

NICKEL	CHRONIC CRITERIA	ARAR	ACUTE CRITERIA	ARAR
SOURCE OF CRITERIA				
WQS-TV5 hardness based	56.4 µg/L	L. Appl.	545 µg/L	L. Appl.
FINAL DISCHARGE LIMITS AND MONITORING FOR NICKEL				
Chronic - monthly average limit based on: TV5, mass balance = 850 µg/L		Acute - no limit. Potential limit greater than untreated discharge.		
Monitoring - weekly, TRec Ni				

**SILVER**

Total silver has been detected in the Argo Tunnel effluent as high as 145 µg/L. Dissolved silver has been detected as high as 8.4 µg/L. Dissolved silver concentrations exceeded the State of Colorado's water quality standards. It is unknown if there is potential dilution for a WLA, as the detection limits in the upstream water quality data were quite high. High detection limits also made it infeasible to calculate metals translator for silver. Therefore, the dissolved silver limits of 0.02 µg/L chronic and 0.62 µg/L acute are directly based on the State chronic and acute TVS. When additional dissolved and total recoverable silver data becomes available, this limit may be increased to reflect the metal translator from dissolved WQS to TRec limits.

SILVER	CHRONIC CRITERIA	ARAR	ACUTE CRITERIA	ARAR
SOURCE OF CRITERIA				
WQS - TVS hardness based	0.02 µg/L	L.Appl.	0.64 µg/L	L.Appl.
FINAL DISCHARGE LIMITS AND MONITORING FOR SILVER				
Chronic - monthly average limit based on: TVS = 0.02 µg/L		Acute - maximum limit based on: TVS = 0.64 µg/L		
Monitoring - weekly, TRec Ag				

## ZINC

The average dissolved zinc concentration for the Argo Tunnel discharge sample results ranged from 40,000 - 116,000  $\mu\text{g/L}$ . The average total zinc concentrations ranged from 40,000 - 108,000  $\mu\text{g/L}$ . Zinc is probably the most significant pollutant of concern for aquatic life at the Argo Tunnel. The State WQS for zinc in this segment is 300  $\mu\text{g/L}$  per liter TRec (chronic). This site specific standard is based on existing water quality minus the zinc contributions from sources which the State expected to be controlled within the next several years, such as the Argo Tunnel. Once the Argo Tunnel Treatment Plant goes on line and the Argo discharge is no longer entering Clear Creek without treatment, it is likely that the State will reevaluate the 300  $\mu\text{g/L}$  standard. Because of the likelihood that the WQSs will change on Clear Creek, the control mechanism discharge limit is based on protecting brown and brook trout. The final total recoverable chronic zinc discharge limit is 225  $\mu\text{g/L}$ , which works out to a dissolved water quality goal of 155  $\mu\text{g/L}$  Zn. At a later date, we anticipate the 225  $\mu\text{g/L}$  Zn limit will be revised to reflect actual Argo Treatment Plant performance or a new site specific WQS for Zn. It should be noted that the dissolved zinc concentration in Clear Creek averages around 240  $\mu\text{g/L}$  upstream of the Argo.

The underlying table value standards of 59 and 65  $\mu\text{g/L}$  Zn chronic and acute, respectively (@ 50 mg/L hardness) were not applied because: (1) the TVS are not legally applicable for Zn in this Clear Creek segment 11 as there is an existing ambient-based WQS, (2) the state may eventually establish a revised site specific water quality standard for zinc between 100-225  $\mu\text{g/L}$ , and (3) the treatment technology is not expected to constantly achieve 45  $\mu\text{g/L}$  zinc. The treatment plant will operate normally at half or less of the 225  $\mu\text{g/L}$  Zn limit, but treatment of zinc is highly dependent on pH. At other similar treatment plants (i.e. Yak and Leadville Mine Drainage Tunnels), we have found zinc levels increase to 200-400  $\mu\text{g/L}$  in response to small changes in pH.

ZINC ( $\mu\text{g/L}$ )	CHRONIC CRITERIA	CHRONIC LIMIT	ARAR	ACUTE CRITERIA	ACUTE LIMIT	ARAR
SOURCE OF CRITERIA						
Hardness based TVS	59 DIS	85 Trec	Rel.	65 DIS	94 Trec	Rel.
Several Trout Studies	100 - 150	145 - 217	TBC			
BPI, protection of brown/brook trout	155	225 TRec	TBC			L.Appl.
Site Specific WQS, just upstream of Argo (Seg 2)	200 Trec	200	Rel.			
Future Site Specific WQS based on water quality after Argo Treatment Plant and other remediation.	Estimated between 150-300	Unknown at this time.				
Site Specific WQS at Argo (Seg 11)	300 TRec	434	L.Appl.			
CO - DOW Trout Criteria: Rainbow ' Brown Brook	47 Dis 225 532-1368	68 326 770-2,000	TBC	240-800 Dis 640 2,000		TBC

FINAL DISCHARGE LIMITS AND MONITORING FOR ZINC	
Chronic - monthly average limit based on: Protecting brown and brook trout = 225 $\mu\text{g/L}$	Acute - no limit
Monitoring - weekly, TRec Zn	

## WHOLE EFFLUENT TOXICITY

Whole Effluent Toxicity (WET) limits and monitoring are required in this control mechanism to detect and eliminate toxicity in the event its presence is unknown, or caused by aluminum or interaction between otherwise innocuous substances. The requirements for WET testing are in accordance with the latest version of the "Region VIII Whole Effluent Toxics Control Program". The State of Colorado's Colorado Water Quality Control Division Biomonitoring guidance indicates that WET testing requirements are applicable to the Argo discharge because Clear Creek is classified as Class I Aquatic Life.

The instream Waste Concentration (IWC) is used to determine whether acute or chronic WET testing is required. The IWC is a ratio of the discharge flow rate and the chronic low flow for the receiving stream ( $IWC = Q_d / (Q_r + Q_d) \times 100$ ). If the IWC is less than or equal to 9.1%, acute conditions apply. The IWC for the Argo discharge is 4.1%; therefore this control mechanism will require quarterly acute toxicity testing using two species (*Ceriodaphnia* sp. and fathead minnows) starting January 1998. Starting October 1, 1998, the discharge limit shall be "no acute toxicity".

WET testing must be conducted on a an effluent dilution series (100%, 75%, 50%, 25%, 12.5%, 6.25% and 0% (control)). This dilution series is required to account for a potential increase in toxicity with a corresponding decrease in hardness. A change to a different dilution series or a reduction to the most critical dilutions may be allowed if deemed appropriate at a later date. Acute toxicity occurs when 50 percent or more mortality is observed for either species at any effluent concentrations. Mortality in the control must simultaneously be 10 percent or less for the effluent results to be considered valid.

## CONVENTIONAL POLLUTANTS: OIL AND GREASE, TOTAL SUSPENDED SOLIDS, pH, & FLOW

The Colorado Regulations for Effluent Limitations (62), apply to the conventional pollutants. The limit for Oil and Grease is based on this regulation. Limits for total suspended solids (TSS) are based on Best Professional Judgement and are equivalent to the interim limits based on treatment technology for ore mining and milling. The pH limit of 6.5 - 9.0 is based on the aquatic life WQS.

Since the mass balance calculations use the maximum design capacity flow of 700 gpm, limits will be reevaluated if the plant is found to have greater capacity flow than 1.008 MGD (700 gpm). A firm flow limit was not included in the control mechanism, because the Argo Plant will be treating as much of the surges as possible while maintaining treatment performance.

Monitoring is required on a continuous or daily basis for flow and pH. Weekly monitoring is required for TSS and oil and grease.

## ANTI DEGRADATION

Section 31.8 of the State of Colorado's Basic Standards and Methodologies for Surface Water requires an antidegradation review for regulated activities with new or increased water quality impacts that may degrade the quality of State surface waters classified as cold water aquatic life class 1 (the Clear Creek is classified as cold water aquatic life class 1). The antidegradation review is not applicable for the Argo Tunnel treatment plant discharge since the discharge is not a regulated activity as defined in section 31.8 (3) (a) and the discharge is not new. In addition, the diversion of the Argo Tunnel discharge through the treatment plant is anticipated to significantly improve the quality of Clear Creek.

## Other Parameters Evaluated for Limits

Several other pollutants (beryllium, sulfate and fluoride) exceed the water quality standards in the untreated Argo discharge. These pollutants were evaluated further for discharge limits. However, after calculating discharge limits, it became apparent that the discharge without treatment would not exceed the possible limits. These pollutants have been dropped from further consideration.

Parameter	Concentration Argo Discharge	WQS	Possible Discharge Limit
Beryllium	12 -16 µg/L	4 µg/L	61 µg/L
Sulfate	1028 - 2560	250	5,000
Fluoride	1.3 - 3.5	2	31

## Monitoring

Monitoring frequencies and duration are summarized in the table below. The specific parameters, frequencies and sources of samples are listed in Appendix Tables A-9, A-10, A-11 and A-12.

As part of the reopener provision in Part II, Section I, the control mechanism may be reopened based upon monitoring results of the Argo Tunnel treatment plant influent and effluent, and Clear Creek. In addition, the control mechanism may be reopened in the event a waste load allocation is completed for the Clear Creek or WQS are revised. However, it should be noted that requirements of the CERCLA and the NCP generally freeze performance standards at the time the Record of Decision is signed. This requirement is to ensure that an effective and efficient remedial action can be completed without continuously changing clean-up criteria.

### Monitoring for Group 1 Pollutants (≈ Pollutants with Limits)

Effluent monitoring frequencies are generally set at weekly for Group 1 parameters (aluminum, arsenic, cadmium, copper, iron, nickel, lead, silver and zinc). Eventually, frequencies may be reduced to biweekly or monthly for certain parameters if the monitoring results show the treatment plant is consistently effective in treating the Argo Tunnel effluent and the pollutants in the effluent are below

ARARs. Composite samples have been specified for all metals to account for variations in the effluent quality resulting from treatment plant operations. Flow and pH shall be monitored continuously or daily. Whole effluent toxicity shall be monitored quarterly. Monitoring for these parameters are "substantive" requirements under Superfund. Other effluent monitoring will be conducted for parameters with limited data, and indicator and watershed parameters.

MONITORING SUMMARY			
Sample	Parameter	Frequency	Duration
Effluent	Metals with limits, O&G, hardness, TSS	Weekly	Long term
Effluent	pH, flow	Continuously, daily	Long term
Effluent	WET	Quarterly	Long term
Effluent	More information needed parameters	Every other month	9 Months
Effluent	Indicator parameters	Every other month 1st year, quarterly thereafter	Long term
Effluent	Watershed parameters	Every other month	One year
Influent	Metals with limits, pH, flow	Every other month 1st year, quarterly thereafter	Long term
Influent	More information parameters	Every other month	One year
Influent	Indicator/watershed parameters	Every other month 1st year, quarterly thereafter	Long term
By-pass	Metals with limits, O&G	Twice monthly	Long term
By-pass	pH, flow	Daily	Long term
Clear Creek Up&Down Stream	Metals with limits, pH flow, hardness	Every other month 1st year, quarterly thereafter	Long term
Clear Creek Up&Dwn	More information parameters	Every other month	First year
Clear Creek Up&Dwn	Watershed parameters	Every other month 1st year, quarterly thereafter	Long term

### Monitoring for Parameters with Limited Data

Additional influent and/or effluent monitoring will be conducted every other month for one year (6 monitoring events) for several parameters with limited data or poor detection limits (generally, Group 3 pollutants of concern). Based on the limited data, these pollutants did not need limits. This additional data will be used to reevaluate these parameters at the end of monitoring. Monitoring for these parameters are generally "substantive" requirements under Superfund.

### Monitoring for Watershed or Indicator Pollutants

Influent and/or effluent monitoring will be conducted every other month for the first year of operation for indicator parameters or parameters of interest to the Upper Clear Creek Watershed or Standley Lake Users. After the first year, the indicator parameters will be monitored quarterly. These monitoring requirements are not considered "substantive" under Superfund.

### Influent Monitoring

There are several reasons to monitor plant influent or the untreated Argo discharge: (1) EPA and the State will need to evaluate treatment plant removal efficiencies, (2) more information is needed for several parameters to confirm no limit decision, (3) identify changes in Argo Tunnel discharges (i.e. more or less metals over time, seasonal variability), (4) identify new mine discharges to the Argo Tunnel. Changes in nitrate and cyanide concentrations may indicate new mining. Oil and grease (effluent) monitoring also monitors new activity or dumping. These monitoring requirements are generally considered "substantive" under Superfund.

Influent monitoring will be every other month for the first year and quarterly thereafter for aluminum, arsenic, cadmium, copper, iron, nickel, lead, silver, zinc (all metals TRec except as noted) nitrite, nitrate and cyanide WAD (weak acid dissociable).

For one year the following parameters will be monitored every other month (6 monitoring events total) mercury (total), selenium, thallium, chromium, chromium <sup>+6</sup>, uranium, radium 226 & 228, and gross alpha.

### By-Pass Monitoring

During major (greater than 700 gpm) blow-out/high flow conditions, a portion of the Argo Tunnel discharge will by-pass the treatment plant. For more information, see the discussion of by-passes on page 11. No limits apply, but the by-pass will be monitored daily for pH and flow. The by-pass will also be monitored for the metals with limits during the first week, and every other week thereafter, during discharge. If the discharge is less than seven days, then no sample will be taken. By-pass samples may also serve as the influent sample for that month. These monitoring requirements are considered "substantive" under Superfund.

### Instream Monitoring

Clear Creek water quality upstream and downstream of the Argo Tunnel discharge is to be monitored every other month for the first year and quarterly thereafter to determine comprehensive impacts on the receiving water. Clear Creek will be monitored at SW-7a upstream of the Argo Tunnel at the 23rd Street bridge and SW-5 at the Gilson Street bridge. The parameters to be monitored are listed in Table A-11.

In-stream monitoring for pollutants of concerns will be conducted until the control mechanism is amended or replaced. The number of parameters and the frequency of monitoring are likely to decrease in several years as the instream effects of the Argo Treatment Plant are documented and data gaps are filled. For pollutants with limited information, the monitoring will be for the first year only. For the majority of metals, both dissolved and total recoverable analysis will be conducted. In-stream sampling using both analytical techniques develops more data for the metals translator factor, evaluates in-stream compliance with ARARs, and provides data for evaluating the toxic effects of metals. In-stream winter monitoring need only be conducted when the stream is open. See Table A-12 for the parameters and frequency. Instream monitoring is a mixture of "substantive" and "administrative" requirements under Superfund.

Duration of ARARs Compliance Document:

The *ARARs Compliance Document*, including the specific discharge limits, monitoring and reporting requirement in Part II, the Discharge Control Mechanism will be reviewed at least every five years.

The *ARARs Compliance Document* may be reopened by EPA or State Superfund programs at any time based on monitoring results, waste load allocations, total maximum daily loads, WQS revisions or other new information.

ARARs Compliance Document:

Prepared By: Bruce Kent, EPA P2-W-P & Dana Allen, EPA EPR-EP

Reviewed by: Phil Hegeman & Don Holmer, CDPHE  
Ron Abel & Rick Brown, CDPHE  
Rob Eber, State AG Office  
Holly Fliniau, EPA EPR-SR  
Richard Baird, EPA ENF-L

**Appendix A**  
**Argo Tunnel ARARs Compliance Document**  
**Data Tables**

<b><u>TABLE</u></b>	<b><u>SUBJECT</u></b>
A-1	Historic Argo Water Quality and Limitation Evaluation
A-2	Water Quality Data on Clear Creek above Argo Tunnel
A-3	Water Quality Data on Clear Creek above Argo Tunnel
A-4	Interim Effluent Limitations
A-5	Potential ARAR Water Quality Standards
A-6	Water Quality Standard Based Effluent Limits Evaluation
A-7	Metals Translator Evaluation
A-8	Metal Effluent Limit Comparison
A-9	Final Effluent Limitations
A-10	First Year Influent and Effluent Monitoring
A-11	Second Year and Later Influent and Effluent Monitoring
A-12	Instream Monitoring Requirements

Draft - November 24, 1997

ARGO TUNNEL TREATMENT PLANT

ARARS COMPLIANCE DOCUMENT  
PART II - DISCHARGE CONTROL MECHANISM

**Draft**

U.S. ENVIRONMENTAL PROTECTION  
AGENCY, REGION VIII  
999 18TH STREET, SUITE 500  
DENVER, COLORADO 80202-2466

COLORADO DEPARTMENT OF PUBLIC  
HEALTH AND ENVIRONMENT  
4300 CHERRY CREEK DRIVE SOUTH  
DENVER, COLORADO 80222-1530

ARGO TUNNEL  
ARARS COMPLIANCE DOCUMENT  
Discharge Control Mechanism

The U.S. Environmental Protection Agency,  
Colorado Department of Public Health and the Environment, and CDPHE's Operator of the

**Argo Tunnel Treatment Plant**

will be implementing a Superfund Remedial Action that will treat acid mine drainage from the Argo Tunnel and discharge to Clear Creek. The facility is located in Clear Creek County, in Idaho Springs, Colorado.

The treatment plant shall operate in accordance with discharge points, effluent limitations, monitoring requirements and other conditions set forth herein. This discharge control mechanism establishes specific discharge requirements that will comply with the Federal and State applicable or relevant and appropriate requirements (ARARs) established in the "Clear Creek Superfund Site Operable Unit #3, Record of Decision," dated September 30, 1991.

These requirements shall become effective January ?, 1998.

Signed this \_\_\_\_\_ day of \_\_\_\_\_

\_\_\_\_\_  
Max H. Dodson  
Assistant Regional Administrator  
Office of Ecosystems Protection and  
Remediation, Region VIII  
Environmental Protection Agency

\_\_\_\_\_  
Howard Roitman  
Director, Hazardous Materials and  
Waste Management  
Colorado Department Of Public Health And  
Environment

## TABLE OF CONTENTS

### Cover Sheet--Effective Date and Signature Page

#### I. Effluent Limitations and Monitoring Requirements

- A. Definitions
- B. Description of Discharge Points
- C. Interim Limitations
- D. Final Limitations
- E. Self-Monitoring Requirements

#### II. Monitoring, Recording and Reporting Requirements

- A. Representative Sampling
- B. Monitoring Procedures
- C. Reporting of Monitoring Results
- D. Compliance Schedules
- E. Additional Monitoring by the Owner or Operator
- F. Records Content
- G. Retention of Records
- H. Twenty-four Hour Notice of Noncompliance Reporting
- I. Other Noncompliance Reporting

#### III. Compliance Responsibilities

- A. Duty to Comply
- B. Duty to Mitigate
- C. Proper Operation and Maintenance
- D. Removed Substances
- E. Bypass of Treatment Facilities
- F. Upset Conditions
- G. Changes in Discharge of Toxic Substances

#### IV. General Requirements

- A. Planned Changes
- B. Anticipated Noncompliance
- C. Continuing Discharge Control Mechanism
- D. Other Information
- E. Signatory Requirements
- F. Availability of Reports
- G. Severability
- H. Transfers
- I. Reopener Provision
- J. Toxicity Limitation-Modification Provision

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

### A. Definitions.

1. The "30-day (and monthly) average" is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month, whichever is applicable. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.
2. "Daily Maximum" ("Daily Max") is the maximum value allowable in any single sample or instantaneous measurement.
3. "Composite samples" shall be flow proportioned. The composite sample shall, as a minimum, contain at least four (4) samples collected over the compositing period. Unless otherwise specified, the time between the collection of the first sample and the last sample shall not be less than six (6) hours nor more than 24 hours. Acceptable methods for preparation of composite samples are as follows:
  - a. Constant time interval between samples, sample volume proportional to flow rate at time of sampling;
  - b. Constant time interval between samples, sample volume proportional to total flow (volume) since last sample. For the first sample, the flow rate at the time the sample was collected may be used;
  - c. Constant sample volume, time interval between samples proportional to flow (i.e., sample taken every "X" gallons of flow); and,
  - d. Continuous collection of sample, with sample collection rate proportional to flow rate.
4. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.
5. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.
6. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based control mechanism effluent limitations because of factors beyond the reasonable control of the Operator. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
7. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

### A. Definitions (cont.).

8. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
9. "RPM" means the EPA Remedial Program Manager for the Clear Creek Superfund Site.
10. "EPA" means the United States Environmental Protection Agency.
11. "State Project Officer" or "SPO" means the Colorado Program Manager or Project Officer(s) for the Clear Creek Superfund Site.
12. "Total Recoverable Metals" means that portion of a water and suspended sediment sample measured by the total recoverable analytical procedure described in "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, March, 1979, or its equivalent.
13. "Acute Toxicity" occurs when 50 percent or more mortality is observed for either species (See Part I.E) at any effluent concentrations. Mortality in the control must simultaneously be 10 percent or less for the effluent results to be considered valid.
14. "Operator" means the company or individual that has contracted with the Colorado Department of Public Health and the Environment - Superfund to operate the Argo treatment Plant.
15. "CDPHE" means the Colorado Department of Public Health and the Environment.
16. "EPA Superfund" means the EPA RPMs and/or managers of the EPA's Superfund, Remedial Response Program.
17. "NPDES/Water" means the EPA and/or State NPDES permit writers and managers or the EPA and/or State NPDES permit programs.

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

B. Description of Discharge Points

The Superfund Remedial Action at the Argo Tunnel will involve discharges at the locations designated below:

<u>Number</u>	<u>Description of Discharge Point</u>
001	Outfall 001 is the outfall from the Argo Tunnel Treatment plant prior to contact or commingling with any surface or ground water. Outfall 001 will be monitored after the clear well.
002	Outfall 002 is the outfall from the bypass structure which diverts flow from the Argo Tunnel around the Argo Tunnel Treatment plant. Outfall 002 will be monitored in the channel just below the plant intake structure.

C. Interim Limitations

1. During the period beginning immediately and lasting through **90 days** after the treatment plan begins treating water, EPA and CDPHE-Superfund and the Operator will discharge from Outfall 001. Such discharges shall be limited by the Operator as specified below:

Existing water quality shall be maintained to the maximum extent possible during construction and treatment equipment startup and testing.

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

C. Interim Limitations (Cont.)

2. After the 90-day startup period, and lasting through September 30, 1998, EPA and CDPHE-Superfund and the Operator will discharge from Outfall 001. Such discharges shall be limited by the Operator as specified below:

Interim Discharge Limitations		
Parameter	30-Day Avg. a/	Daily Max a/
Flow, MGD	Report	1.008k/
pH, s.u. g/	N/A	6.5 - 9.0
Oil and Grease, mg/L f/	Report	10.0
Total Suspended Solids, mg/L	20	30
Cadmium, TRec, µg/L j/	50	100
Copper, TRec, µg/L	150	300
Lead, TRec, µg/L	300	600
Zinc, TRec, µg/L	750	1,500
Whole Effluent Toxicity, Acute	-	Report

There shall be no discharge of floating solids or visible foam in other than trace amounts

Footnotes: See page 8

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

D. Final Limitations

- During the period from October 1, 1998, and lasting until the control mechanism is modified or replaced, discharges from Outfall 001 shall be limited as specified below:

Final Discharge Limitations		
Parameter	30-Day Avg. <u>a/d/</u>	Daily Max <u>a/</u>
Flow, MGD	Report	1.008 <u>k/</u>
pH, s.u. <u>g/</u>	N/A	6.5 - 9.0
Oil and Grease, mg/L <u>f/</u>	N/A	10.0
Total Suspended Solids, mg/L	20	30
Arsenic, TRec, $\mu\text{g/L}$ <u>j/</u>	Report	400
Cadmium, TRec, $\mu\text{g/L}$	3	Report
Copper, TRec, $\mu\text{g/L}$	17	35
Iron, TRec, $\mu\text{g/L}$	15,800	Report
Lead, TRec, $\mu\text{g/L}$	4.75	905
Manganese, TRec, $\mu\text{g/L}$	800	Report
Nickel, TRec, $\mu\text{g/L}$	850	Report
Silver, TRec, $\mu\text{g/L}$ <u>b/</u>	0.02	0.62
Zinc, TRec, $\mu\text{g/L}$	225	Report
Whole Effluent Toxicity, Acute	N/A	$\text{LC}_{50} > 100\%$ <u>h/</u>

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Footnotes: See page 8

- During the life of the control mechanism, bypasses are prohibited except for the limited conditions described in Section III.E. EPA and CDPHE-Superfund and the Operator will discharge during bypass and/or upset conditions through Outfall 002. Discharges from Outfall 002 shall be limited as specified below:

No limits apply during bypass and/or upset conditions

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

## Footnotes:

- a/ See Definitions, Part I.A. of the control mechanism for definition of terms.
- b/ Based on the Methods for Chemical Analyses of Water and Waste 1983 ed., the graphite furnace method (272.2) for silver has a method detection limit of 0.2 ug/L. Based on the Methods for Chemical Analyses of Water and Waste 1983 ed., the cold vapor method (245.1) for mercury has a method detection limit of 0.2 ug/L. Analytical values less than the MDLs should be reported as such and shall be considered to be in compliance with any applicable effluent limitations. For the purpose of this discharge control mechanism, the practical quantitation level for total mercury and total recoverable silver is considered to be 0.6 ug/L. Analytical values less than 0.6 ug/L shall be reported as zero and will be considered to be in compliance with the effluent limitation for total recoverable silver. For averaging calculations of mercury and silver analytical results, measurements less than the practical quantitation level shall be considered as 0.
- c/ The hardness shall either be directly measured or be calculated from the monitoring data for total calcium and magnesium and samples shall be taken when ambient (instream) sampling is conducted.
- d/ For averaging calculations of analytical results (except Hg, Ag), measurements less than the detection limit shall be considered one half the detection limit.
- e/ The monitoring frequencies may be revised upon agreement of EPA and CDPHE and modification of the control mechanism.
- f/ A grab sample shall also be taken if a visual sheen is observed.
- g/ Daily minimum - daily maximum limitation.
- h/ Effective October 1, 1998, there shall be no acute toxicity in the discharges from Outfall 001.
- I/ Free cyanide samples shall be analyzed using ASTM D2306-81 Method C (WAD).
- j/   Diss.    - Dissolved  
     TRec    - Total Recoverable  
     WAD     - Weak Acid Dissociable
- Bimonthly - Every other month, total of 6 times per year
- k/ Flow is not a limit. If plant capacity regularly exceeds 1.008 mgd, discharge limits will need to be reevaluated.

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements

## 1. Interim Effluent (First Year) Monitoring Requirements

Beginning at the initiation of treatment and lasting through September 30, 1998, discharges from Outfall 001 shall be monitored by the Operator as specified below:

Interim Effluent Monitoring Requirements through 9/30/98		
Parameter	Frequency a/ e/	Sample Type a/
Flow, MGD	Daily	Instantaneous
pH, s.u.	Daily	Inst. Or Grab
Oil and Grease, mg/L f/	Daily Visual	Grab
Hardness, mg/L as CaCO <sub>3</sub> c/	Weekly	24-hr. Comp.
Total Suspended Solids, mg/L	Weekly	24-hr. Comp.
Aluminum, TRec, µg/L j/	Weekly	24-hr. Comp.
Arsenic, TRec, µg/L	Weekly	24-hr. Comp.
Cadmium, TRec, µg/L	Weekly	24-hr. Comp.
Copper, TRec, µg/L	Weekly	24-hr. Comp.
Iron, TRec, µg/L	Weekly	24-hr. Comp.
Lead, TRec, µg/L	Weekly	24-hr. Comp.
Manganese, TRec, µg/L	Weekly	24-hr. Comp.
Nickel, TRec, µg/L	Weekly	24-hr. Comp.
Silver, TRec, µg/L b/	Bimonthly	24-hr. Comp.
Zinc, TRec, µg/L	Weekly	24-hr. Comp.
Beryllium, TRec, µg/L	Bimonthly	24-hr. Comp.
Chromium, TRec, µg/L	Bimonthly	24-hr. Comp.
Chromium <sup>6+</sup> , Diss., µg/L	Bimonthly	Grab

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements

## 1. Interim Effluent Monitoring Requirements (cont.)

Interim Effluent Monitoring Requirements through 9/30/98		
Parameter	Frequency a/ c/	Sample Type a/
Uranium, Diss., µg/L	Bimonthly	Grab
Nitrate-N, mg/L	Bimonthly	Grab
Nitrite-N, mg/L	Bimonthly	Grab
Ammonia-N, mg/L	Bimonthly	Grab
Total Phosphorous-P, mg/L	Bimonthly	24-hr. Comp.
Chloride, mg/L	Bimonthly	24-hr. Comp.
Sulfate, mg/L	Bimonthly	24-hr. Comp.
Fluoride, mg/L	Bimonthly	24-hr. Comp.
Whole Effluent Toxicity, Acute	Quarterly	Grab

Footnotes: See page 8

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements (Cont.)

## 2. Final Effluent Monitoring Requirements

During the period from **October 1, 1998** and lasting until the control mechanism is modified or replaced, discharges from Outfall 001 shall be monitored by the Operator as specified below:

Final Effluent Monitoring Requirements		
Parameter	Frequency a/ e/	Sample Type a/
Flow, MGD	Daily	Instantaneous
pH, s.u. g/	Daily	Grab or Inst.
Oil and Grease, mg/L f/	Weekly Visual	Grab
Hardness, mg/L as CaCO <sub>3</sub> c/	Weekly	24-hr. Comp.
Total Suspended Solids, mg/L	Weekly	24-hr. Comp.
Aluminum, TRec, µg/L j/	Weekly	24-hr. Comp.
Arsenic, TRec, µg/L	Weekly	24-hr. Comp.
Cadmium, TRec, µg/L	Weekly	24-hr. Comp.
Copper, TRec, µg/L	Weekly	24-hr. Comp.
Iron, TRec, µg/L	Weekly	24-hr. Comp.
Lead, TRec, µg/L	Weekly	24-hr. Comp.
Manganese, TRec, µg/L	Weekly	24-hr. Comp.
Nickel, TRec, µg/L	Weekly	24-hr. Comp.
Silver, TRec, µg/L b/	Weekly	24-hr. Comp.
Zinc, TRec, µg/L	Weekly	24-hr. Comp.
Whole Effluent Toxicity, Acute	Quarterly	Grab

Footnotes: See page 8

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements (Cont.)

## 3. Influent Monitoring

Beginning at the initiation of treatment and lasting until the control mechanism is amended or replaced, the Operator shall monitor the influent to the treatment plant as specified below:

Influent Monitoring Requirements		
Parameter	Frequency <sup>a/</sup> c/	Sample Type <sup>a/</sup>
Flow, MGD	Daily	Instantaneous
pH, s.u.	Daily	Cont./Grab
Aluminum, TRec, $\mu\text{g/L}$ j/	Bimonthly/Quarterly <sup>1</sup>	24-hr. Comp.
Arsenic, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Cadmium, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Copper, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Iron, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Manganese, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Nickel, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Lead, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Silver, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Zinc, TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	24-hr. Comp.
Nitrate-N, mg/L	Bimonthly/Quarterly	Grab
Nitrite-N, mg/L	Bimonthly/Quarterly	Grab
Cyanide, WAD, $\mu\text{g/L}$ l/	Bimonthly/Quarterly	Grab

<sup>1</sup> Bimonthly first year (1/98-1/99); Quarterly in second and later years (2/99 and later).

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements (Cont.)

## 4. Additional First Year Influent Monitoring

Starting **January 1, 1998**, and lasting for one full year, the Operator shall monitor the following parameters at the influent to the treatment plant and Outfall 001 on a bimonthly basis until six sets of data are available. Parameters shall be analyzed using the methods specified below. Parameter concentrations shall be reported in the units specified below. The data is to be submitted as an attachment to the Discharge Monitoring Report. Analytical detection limits shall be at or below Colorado State water quality standards.

First Year Monitoring Requirements		
Parameter	Frequency <i>p, c</i>	Sample Type <i>p</i>
Beryllium , TRec, , $\mu\text{g/L}$ <i>j</i> /	Bimonthly	24-hr. Comp.
Mercury , Total, $\mu\text{g/L}$ <i>b</i> /	Bimonthly	24-hr. Comp.
Selenium , TRec, $\mu\text{g/L}$	Bimonthly	24-hr. Comp.
Thallium , TRec, $\mu\text{g/L}$	Bimonthly	24-hr. Comp.
Ammonia-N, mg/L	Bimonthly	Grab
Uranium , Diss., mg/L	Bimonthly	Grab
Radium 226 and Radium 228, pCi/L	Bimonthly	Grab
Gross Alpha, pCi/L	Bimonthly	Grab

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements (Cont.)

5. Long term Upstream and Downstream Water Quality Monitoring of Clear Creek at Stations SW-7a at the 23rd Street bridge and SW-05 at the Gilson Street bridge.

Starting within one month of the control mechanism effective date, the Owner or Operator will monitor the following parameters on a bimonthly basis for the first year and on a quarterly basis for the remaining term of the control mechanism at Stations SW-7a (upstream) and SW-05 on Clear Creek. Instream winter/spring monitoring need only be conducted when the stream is open and it is safe to sample. The data are to be submitted as an attachment to the Discharge Monitoring Report.

Long Term Instream Monitoring Requirements		
Parameter	Frequency a/g	Sample Type w/
Aluminum, TRec, µg/L j/	Bimonthly/Quarterly <sup>1</sup>	Grab
Aluminum, Diss., µg/L	Bimonthly/Quarterly	Grab
Arsenic, TRec, µg/L	Bimonthly/Quarterly	Grab
Arsenic, Diss., µg/L	Bimonthly/Quarterly	Grab
Cadmium, TRec, µg/L	Bimonthly/Quarterly	Grab
Cadmium, Diss., µg/L	Bimonthly/Quarterly	Grab
Copper, TRec, µg/L	Bimonthly/Quarterly	Grab
Copper, Diss., µg/L	Bimonthly/Quarterly	Grab
Iron, TRec, µg/L	Bimonthly/Quarterly	Grab
Iron, Diss., µg/L	Bimonthly/Quarterly	Grab
Lead, TRec, µg/L	Bimonthly/Quarterly	Grab
Lead, Diss., µg/L	Bimonthly/Quarterly	Grab
Manganese, TRec, µg/L	Bimonthly/Quarterly	Grab
Manganese, Diss., µg/L	Bimonthly/Quarterly	Grab

<sup>1</sup> Bimonthly/Quarterly - Bimonthly first year, (1/98-1/99); Quarterly in second and later years (2/99 and later).

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

## E. Self-Monitoring Requirements (Cont.)

5. (Continued) Long term Upstream and Downstream Water Quality Monitoring of Clear Creek at Stations SW-7a at the 23rd Street bridge and SW-05 at the Gilson Street bridge.

Long Term Instream Monitoring Requirements (continued)		
Parameter	Frequency a/c/	Sample Type a/
Nickel , TRec, $\mu\text{g/L}$ j/	Bimonthly/Quarterly	Grab
Nickel , Diss., $\mu\text{g/L}$	Bimonthly/Quarterly	Grab
Silver , TRec, $\mu\text{g/L}$ b/	Bimonthly/Quarterly	Grab
Silver , Diss., $\mu\text{g/L}$ b/	Bimonthly/Quarterly	Grab
Zinc , TRec, $\mu\text{g/L}$	Bimonthly/Quarterly	Grab
Zinc , Diss., $\mu\text{g/L}$	Bimonthly/Quarterly	Grab
Total Phosphorous-P, mg/L	Bimonthly/Quarterly	Grab
pH, s.u.	Bimonthly/Quarterly	Grab
Nitrate-N, mg/L	Bimonthly/Quarterly	Grab
Nitrate-N, mg/L	Bimonthly/Quarterly	Grab
Ammonia-N, mg/L	Bimonthly/Quarterly	Grab
Flow, cfs	Bimonthly/Quarterly	Grab
Hardness, mg/L as $\text{CaCO}_3$	Bimonthly/Quarterly	Grab

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements (Cont.)

6. Starting in January 1998, additional first year (1/98-1/99) Upstream and Downstream Water Quality Monitoring of Clear Creek at Stations SW-7a at the 23rd Street bridge and SW-05 at the Gilson Street bridge.

First Year Instream Monitoring Requirements		
Parameter	Frequency a/, c/	Sample Type a/
Beryllium , TRec, µg/L j	Bimonthly	Grab
Beryllium , Diss., µg/L	Bimonthly	Grab
Chromium , TRec, µg/L	Bimonthly	Grab
Chromium (Diss), µg/L	Bimonthly	Grab
Chromium <sup>6+</sup> (Diss), µg/L	Bimonthly	Grab
Mercury (Total), µg/L l b/	Bimonthly	Grab
Mercury , Diss., µg/L l b/	Bimonthly	Grab
Selenium , TRec, µg/L	Bimonthly	Grab
Selenium , Diss., µg/L	Bimonthly	Grab
Thallium , TRec, µg/L	Bimonthly	Grab
Thallium , Diss., µg/L	Bimonthly	Grab
Uranium , Diss., µg/L	Bimonthly	Grab
Radium 226 and Radium 228, pCi/L	Bimonthly	Grab
Gross Alpha, pCi/L	Bimonthly	Grab

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements (Cont.)

## 7. Bypass Monitoring Requirements (Outfall 002)

Beginning at the initiation of treatment and lasting until the control mechanism is amended or replaced, the Operator shall monitor bypasses of the treatment plant through Outfall 002 as specified below:

Bypass Monitoring Requirements		
Parameter	Frequency <sup>a/</sup> c/	Sample Type <sup>a/</sup>
Flow, MGD	Daily	Instantaneous
pH, s.u. <sup>g/</sup>	Daily	Grab or Inst.
Oil and Grease, mg/L <sup>f/</sup>	Weekly Visual	Grab
Total Suspended Solids, mg/L	2X/Month	24-hr. Comp.
Aluminum, TRec, $\mu\text{g/L}$ <sup>j/</sup>	2X/Month	24-hr. Comp.
Arsenic, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.
Cadmium, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.
Copper, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.
Iron, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.
Lead, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.
Manganese, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.
Nickel, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.
Silver, TRec, $\mu\text{g/L}$ <sup>b/</sup>	2X/Month	24-hr. Comp.
Zinc, TRec, $\mu\text{g/L}$	2X/Month	24-hr. Comp.

## I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)

E. Self-Monitoring Requirements (Cont.)

## 8. Whole Effluent Toxicity Testing - Acute Toxicity

Starting on **January 1, 1998**, the Operator shall conduct quarterly acute toxicity tests on a grab sample of the discharge from Outfall 001 using a full effluent dilution series [100%, 75%, 50%, 25%, 12.5%, 6.25%, and 0% (control)]. Samples shall be collected on a two-day progression; i.e., if the first quarterly sample is on a Monday, during the next quarter, the sampling shall begin on a Wednesday. If acute toxicity is detected, additional samples and different dilutions may be required by either EPA Region VIII or CDPHE-Superfund (see below). If such additional sampling is required, the Operator shall promptly comply with the requests.

The replacement static acute toxicity tests shall be conducted in accordance with the procedures set out in the latest revision of "Methods of Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms" EPA-600/4-90/027 (Rev. August 1993) and the "Region VIII EPA NPDES Acute Test Conditions - Static Renewal Whole Effluent Toxicity Test." In the case of conflicts, the Region VIII procedures will prevail. The Operator shall conduct the acute 48-hour static toxicity test using *Ceriodaphnia dubia* and the acute 96-hours static toxicity test using *Pimephales promelas*.

Acute toxicity occurs when 50 percent or more mortality is observed for either species at any effluent concentration. If more than 10% control mortality occurs, the test shall be repeated until satisfactory control survival is achieved, unless a specific individual exception is granted by EPA Region VIII or CDPHE-Superfund.

After **October , 1998**, if acute toxicity occurs, an additional test shall be conducted within four weeks of the date of the initial sample. If only one species fails, retesting may be limited to this species. Should toxicity occur in the second test, testing shall occur once a month until further notified by EPA Region VIII or CDPHE-Superfund.

Quarterly test results shall be reported along with the Discharge Monitoring Report (DMR) submitted for the end of the reporting calendar quarter (e.g., whole effluent results for the calendar quarter ending March 31 shall be reported with the DMR due April 28, with the remaining reports submitted with DMRs due each July 28, October 28, and January 28). Quarterly test results shall be reported along with the DMR submitted for the month at the end of the calendar quarter. The format for the report shall be consistent with the latest revision of the "Region VIII Guidance for Acute Whole Effluent Reporting" and shall include all chemical and physical data as specified.

**I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Cont.)****E. Self-Monitoring Requirements (Cont.)****8. Whole Effluent Toxicity Testing - Acute Toxicity (Cont.)**

If the results for four consecutive quarters of testing indicate no acute toxicity, EPA Region VIII and CDPHE may agree to modify the control mechanism to allow a reduction in the dilution series or testing on only one species.

**9. Toxicity Identification Evaluation (TIE)  
Toxicity Reduction Evaluation (TRE)**

Should acute whole effluent toxicity be detected in the discharge, a TIE-TRE shall be undertaken by the Operator to establish the cause of the toxicity, locate the source(s) of the toxicity, and develop control of, or treatment for the toxicity. Failure to initiate or conduct an adequate TIE-TRE, or delays in the conduct of such tests, shall not be considered a justification for noncompliance with the whole effluent toxicity limits contained in Part I.D.1. of this control mechanism.

**10. Chronic Toxicity Limitation-Reopener Provision**

This control mechanism may be reopened and modified to include chronic whole effluent toxicity limitations if other information or data are developed indicating that chronic whole effluent toxicity limits are needed to meet the substantive requirements of 40 CFR 122.44 (d). (See also Part IV.M. of this control mechanism for additional whole effluent toxicity reopener provisions.)

If acceptable to EPA Region VIII and CDPHE-Superfund, and if in conformance with current regulations, this control mechanism may be reopened and modified to incorporate TRE conclusions relating to additional numeric limitations, a compliance schedule, and/or modified whole effluent toxicity test protocol.

## II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

- A. Representative Sampling. Effluent samples taken to comply with the monitoring requirements established under Part I shall be collected from the effluent stream prior to discharge into the receiving waters. All effluent, influent by-pass, stream samples, and measurements shall be representative of the volume and nature of the monitored source.
- B. Monitoring Procedures. Monitoring shall be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this control mechanism. Method 272.2 (graphite furnace) and method 245.1 (cold vapor), as listed in the Methods for Chemical Analyses of Water and Wastes 1983 ed., are the required methods for analysis of silver and mercury, respectively.
- C. Reporting of Monitoring Results. Effluent monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. If no discharge occurs during the reporting period, "no discharge" shall be reported. Whole effluent toxicity (biomonitoring) results must be reported on the most recent version of EPA Region VIII's Guidance For Whole Effluent Reporting. Influent, by-pass, and instream monitoring shall be summarized and submitted with the next month's DMR. Legible copies of these, and all other reports required herein, shall be signed and certified in accordance with the Signatory Requirements (see Part IV.), and submitted to the EPA Region VIII-Superfund and the CDPHE-Superfund at the following addresses:

original to: Colorado Department of Public Health and the Environment  
HMWMD-RP-B2 (Remedial Programs Section)  
4300 Cherry Creek Drive South  
Denver, Colorado 80222-1530

copy to: U.S. Environmental Protection Agency  
Region VIII (8EPR-SR)  
Clear Creek RPM  
999 18th Street, Suite 500  
Denver, Colorado 80202-2466

- D. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this control mechanism shall be submitted no later than 14 days following each schedule date.
- E. Additional Monitoring by the Operator. If CDPHE's Operator monitors any pollutant more frequently than required by this control mechanism, using test procedures approved under 40 CFR 136 or as specified in this control mechanism, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated on the DMR.
- F. Records Content. Records of monitoring information shall include:
1. The date, exact place, and time of sampling or measurements;
  2. The initials or name(s) of the individual(s) who performed the sampling or measurements;
  3. The date(s) analyses were performed;
  4. The time(s) analyses were initiated;
  5. The initials or name(s) of individual(s) who performed the analyses;
  6. References and written procedures, when available, for the analytical techniques or methods used; and,
  7. The results of such analyses, including the bench sheets, instrument readouts, computer disks or tapes, etc., used to determine these results.

## II. MONITORING, RECORDING AND REPORTING REQUIREMENTS (Cont.)

- G. Retention of Records. CDPHE's Operator shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, and copies of all reports required by this control mechanism, for six years or until the five year reassessment of the Superfund remedy is completed which ever is longer. Data collected on site, copies of Discharge Monitoring Reports, and a copy of this control mechanism must be maintained on site during the duration of activity at the facility or until otherwise instructed by the SPO.
- H. Twenty-four Hour Notice of Noncompliance Reporting.
1. CDPHE's Operator shall report any noncompliance which may seriously endanger health or the environment as soon as possible, but no later than twenty-four (24) hours from the time the Operator first becomes aware of the circumstances. The report shall be made to the EPA Region VIII Emergency Preparedness, Assessment and Response Program at (303) 293-1788 and the State of Colorado at (303) 756-4455.
  2. The following occurrences of noncompliance shall be reported by telephone to the State of Colorado, HMWMD-RP-B2 (Remedial Programs Section) at (303) 692-3300 and the EPA, Region VIII, Superfund Remedial Program at (303) 312-6870 by the first workday (8:00 a.m. - 4:30 p.m. Mountain Time) following the day the Operator becomes aware of the circumstances:
    - a. Any unanticipated bypass which exceeds any effluent limitation in the control mechanism (see Part III.E., Bypass of Treatment Facilities) including any by-pass discharge from Outfall 002;
    - b. Any upset which exceeds any effluent limitation in the control mechanism (see Part III.F., Upset Conditions); or,
    - c. Violation of a maximum daily discharge limitation for any of the pollutants listed in the control mechanism are to be reported within 24 hours.
  3. A written report shall also be provided within five days of the time that CDPHE's Operator becomes aware of the circumstances. The written report shall contain:
    - a. A description of the noncompliance and its cause;
    - b. The period of noncompliance, including exact dates and times;
    - c. The estimated time noncompliance is expected to continue if it has not been corrected; and,
    - d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
  4. The RPM and the State Project Officer may waive the written report on a case-by-case basis if the oral telephone report has been received within 24 hours by the EPA-Superfund or CDPHE-Superfund by phone, at (303) 312-6870 or (303) 692-3300.
  5. Reports shall be submitted to the addresses in Part II.C., Reporting of Monitoring Results.
- I. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.C. are submitted. The reports shall contain the information listed in Part II.H.3.

## III. COMPLIANCE RESPONSIBILITIES

- A. Duty to Comply. CDPHE will ensure that its Operator of the treatment plan has a contractual duty to comply with all terms and conditions of this control mechanism and as it may be modified in writing. EPA-Superfund and/or CDPHE-Superfund will follow-up on any noncompliance. CDPHE-Superfund and the Operator shall give advance notice of any planned changes at the Argo Tunnel Treatment Plant or of an activity which may result in control mechanism noncompliance to the RPMs and NPDES-Water staff.
- B. Duty to Mitigate. CDPHE-Superfund and its Operator shall take all reasonable steps to minimize or prevent any discharge in violation of this control mechanism which has a reasonable likelihood of adversely affecting human health or the environment.
- C. Proper Operation and Maintenance. CDPHE's Operator shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Operator to achieve compliance with the conditions of this control mechanism. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar, when the operation is necessary to achieve compliance with the conditions of the control mechanism.
- D. Removed Substances. Sludge produced by the treatment system shall be disposed of in compliance with EPA's Superfund off-site disposal policy. The operator will need written approval from the SPO of the off-site disposal site and transportation route.
- E. Bypass of Treatment Facilities.
1. CDPHE's Operator may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it is also for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2. and 3. of this section.
  2. Notice.
    - a. Anticipated bypass. If CDPHE's Operator knows in advance of the need for a bypass, it shall submit prior notice, if possible at least 60 days before the date of the bypass.
    - b. Unanticipated bypass. CDPHE's Operator shall submit notice of an unanticipated bypass as required under Part II.H., Twenty-four Hour Reporting.
  3. Bypass is prohibited unless:
    - a. Influent flows to the Argo Tunnel Treatment plant exceed the design capacity of the facility;
    - b. The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
    - c. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; or
    - d. CDPHE's Operator submitted notices as required under paragraph 2. of this section.

## III. COMPLIANCE RESPONSIBILITIES (Cont.)

F. Upset Conditions.

If an upset occurs, CDPHE's Operator shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

- a. An upset occurred and that the Operator can identify the cause(s) of the upset;
- b. The Argo Tunnel Treatment Plant was at the time being properly operated;
- c. The Operator submitted notice of the upset as required under Part II.H., Twenty-four Hour Notice of Noncompliance Reporting; and,
- d. The Operator complied with any remedial measures required under Part III.B., Duty to Mitigate.

- G. Changes in Discharge of Toxic Substances. CDPHE-Superfund and the Operator shall provide written notification to the RPM of any intent to construct, install, or alter any new process, facility, or activity that is likely to result in a new or altered discharge either in terms of location or effluent quality prior to the occurrence of the new or altered discharge and shall furnish the RPM such plans and specifications which the RPM deems reasonably necessary to evaluate the effect on the discharge and receiving stream.

If the RPM finds that such new or altered discharge might be inconsistent with the conditions of this control mechanism, the RPM in consultation with CDPHE-Superfund and NPDES-Water shall revise the control mechanism to include the new or altered discharge.

## IV. GENERAL REQUIREMENTS

- A. Planned Changes. CDPHE-Superfund and the Operator shall give notice to the RPM as soon as possible of any planned physical alterations or additions to the Argo Tunnel Treatment Plant. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to all pollutants with or without effluent limitations in the control mechanism.
- B. Anticipated Noncompliance. CDPHE's Operator shall give advance notice of any planned changes in the Argo facility or activity which may result in noncompliance with control mechanism requirements.
- C. Continuing Discharge Control Mechanism. Under 121(c) of CERCLA, the Argo Tunnel remedy and the discharge control mechanism will be reviewed at least every five years to assure it is protective of human health and the environment. It is anticipated that, at a minimum, these reviews will evaluate the adequacy of the terms and limitations in the control mechanism. The next five year review is March 1999, followed by March 2004. At least 180 days prior to the five year anniversary, CDPHE's Operator and/or CDPHE Superfund shall submit a report detailing any changes made to the treatment plant, influent and effluent analysis (one each) for all metals, and metalloids with water quality standards or criteria, major cations, radionuclides, cyanide, nutrients, nitrate, nitrite and ammonia.
- D. Other Information. When CDPHE's Operator becomes aware that it failed to submit any relevant facts, or submitted incorrect information in any report to the SPO or RPM, it shall promptly submit such facts or information.

## IV. GENERAL REQUIREMENTS (Cont.)

- E. Signatory Requirements. All reports or information submitted to CDPHE-Superfund and EPA by the Operator shall be signed and certified by a duly authorized representative of the Operator.
1. A person is a duly authorized representative only if: the authorization is made in writing and submitted to the State Project Officer, and the authorization specified either an individual or a position having responsibility for the overall operation of the facility or activity, such as the position of plant manager, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
  2. Changes to authorization. If an authorization under paragraph IV.E.1. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.E.1. must be submitted to the State Project Officer prior to or together with any reports, information, or applications to be signed by an authorized representative.
  3. Certification. Any person signing a document under this section shall make the following certification:  
  
"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete."
- F. Availability of Reports. Except for data determined to be confidential business information, under 40 CFR Part 2, all reports prepared in accordance with the terms of this control mechanism shall be available for public inspection at the offices of the Colorado Department of Public Health and the Environment and the EPA Superfund Records Center.
- G. Severability. The provisions of this control mechanism are severable, and if any provision of this control mechanism, or the application of any provision of this control mechanism to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this control mechanism, shall not be affected thereby.
- H. Transfers. This control mechanism may be automatically transferred to a new Operator upon agreement between EPA-Superfund and CDPHE-Superfund. CDPHE-Superfund will notify the RPM at least 30 days in advance of the proposed transfer date.

## IV. GENERAL REQUIREMENTS (Cont.)

- L. Reopener Provision. Modification(s) of the control mechanism will be made by EPA-Superfund in consultation with CDPHE-Superfund and NPDES-Water. Any modification(s) could potentially require an explanation of significant differences from the ROD. This control mechanism may be modified pursuant to Part IV.C or as set forth below to include the appropriate effluent limitations (and compliance schedule, if necessary), or other appropriate requirements. This document may be reopened if one or more of the following events occurs:
1. **Water Quality Standards:** The water quality standards of the receiving water(s) to which the CDPHE's Operator discharges are modified in such a manner as to require different effluent limits than contained in this control mechanism.
  2. **Wasteload Allocation:** A wasteload allocation is developed and approved by the State and/or EPA for incorporation in this control mechanism.
  3. **Water Quality Management Plan:** A revision to the current water quality management plan is approved and adopted which calls for different effluent limitations than contained in this control mechanism.
  4. **Monitoring Results:** The results of the analysis of the Argo Tunnel Treatment Plant influent and effluent indicate additional parameters of concern.
  5. **Treatment Technology based limits** are developed.
- M. Toxicity Limitation-Modification Provision. This control mechanism may be modified to include a new compliance date, additional or modified numerical limitations, a new or different compliance schedule, a change in the whole effluent protocol, or any other conditions related to the control of toxicants if one or more of the following events occur:
1. Toxicity is detected late in the life of the control mechanism near or past the deadline for compliance.
  2. The TRE results indicate that compliance with the toxic limits will require an implementation schedule past the date for compliance and EPA and CDPHE agrees with the conclusion.
  3. The TRE results indicate that the toxicant(s) represent pollutant(s) that may be controlled with specific numerical limits, and CDPHE and EPA agree that numerical controls are the most appropriate course of action.
  4. Following the implementation of numerical controls on toxicants, CDPHE and EPA agree that a modified whole effluent protocol is necessary to compensate for those toxicants that are controlled numerically.
  5. The TRE reveals other unique conditions or characteristics which, in the opinion of EPA and CDPHE, justify the incorporation of unanticipated special conditions in the control mechanism.

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Comment
Flow (cfs)	76/77	0.45	0.37 - 0.55	14			L,M	
Flow (cfs)	OU1-FS	0.46	0.26 - 0.86	18				7/85-12/86
Flow (cfs)	RI-IA	0.21		1				4/87
Flow (cfs)	RI-II	0.45	0.41 - 0.49	2				6/89, 9/89
Flow (cfs)	SWSR	0.46		1				4/92
pH (s.u.)	76/77	2.9	2.9 - 3.1	14		6.5 - 9.0	L,M	
pH (s.u.)	OU1-FS	2.63	2.5 - 2.9	6				7/85-6/86
pH (s.u.)	RI-IA	3.2		1				4/87
pH (s.u.)	RI-II	2.3	2.1 - 2.5	2				6/89, 9/89
Total Dis. Solids (mg/L)	76/77	2,950	2710 - 3110	11			N	
Total Dis. Solids (mg/l)	OU1-FS	3,465	3120 - 3990	5				7/85-6/86
Total Dis. Solids (mg/L)	RI-II	3,300		1				6/89
Dis. Aluminum (µg/L)	OU1-FS	27,600	19,000-55,900	5		87/750	L,M	7/85-6/86
Dis. Aluminum (µg/L)	RI-IA	23,200		1				4/87
Dis. Aluminum (µg/L)	RI-II	24,450	19,900-29,000	2				6/89, 9/89
Total Aluminum (µg/L)	OU1-FS	19,600		5			OM	7/85-6/86

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Com-ment
Total Aluminum (µg/L)	RI-IA	23,200		1				4/87
Total Aluminum (µg/L)	RI-II	24,450	19,900-29,000	2				6/89, 9/89
Total Aluminum (µg/L)	RD	30,220	22,000-56,000	10				
Total Aluminum (µg/L)	SWSR	31,600		1				4/92
Dis. Antimony (µg/L)	76/77	0.6	0.0 - 2	14			N	
Dis. Antimony (µg/L)	OU1-FS	0.0	0.0 - 0.0	5				7/85- 6/86
Total Antimony (µg/L)	76/77	0.9	0.0 - 2	14		6.0	N	
Total Antimony (µg/L)	OU1-FS	0.0	0.0 - 0.0	5				7/85- 6/86
Total Antimony (µg/L)	SWSR	0.0		1				4/92
Dis. Arsenic (µg/L)	76/77	122	100 - 160	13		360/150	L,M	
Dis. Arsenic (µg/L)	OU1-FS	145	64 - 208	5				
Dis. Arsenic (µg/L)	RI-II	62.5	33 - 92	2				
Total Arsenic (µg/L)	76/77	135	100 - 180	14		50	L,M	
Total Arsenic (µg/L)	OU1-FS	132	71 - 226	5				7/85- 6/86
Total Arsenic (µg/L)	RI-II	66.5	35 - 98	2				6/89, 9/89
Total Arsenic (µg/L)	SWSR	238		1				4/92
Dis. Barium (µg/L)	76/77	0.0	0.0 - 0.0	14				
Dis. Barium (µg/L)	OU1-FS	0.0	0.0 - 0.0	5				7/85- 6/86

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> /Monitoring	Com-ment
Total Barium (µg/L)	76/77	?	?	?		1000	N	
Total Barium (µg/L)	OU1-FS	0.0	0.0 - 0.0	5				7/85-6/86
Total Barium (µg/L)	SWSR	0.0		1				4/92
Dis. Beryllium (µg/L)	OU1-FS	13	12 - 16	5		4.0	L,M	7/85-6/86
Total Beryllium (µg/L)	OU1-FS	13	12 - 14	5				7/85-6/86
Total Beryllium (µg/L)	SWSR	15		1				4/92
Dis. Boron (µg/L)	OU1-FS	192	145 - 232	3			N	7/85-6/86
Total Boron (µg/L)	OU1-FS	185	113 - 227	3		750	N	7/85-6/86
Dis. Cadmium (µg/L)	76/77	151	130 - 170	11		1.8/3	L,M	
Dis. Cadmium (µg/L)	OU1-FS	213	122 - 540	5				7/85-6/86
Dis. Cadmium (µg/L)	RI-II	121.5	120 - 123	2				6/89, 9/89
Total Cadmium (µg/L)	76/77	151	130 - 170	13		5.0/10	L,M	
Total Cadmium (µg/L)	OU1-FS	255	111 - 770	5				7/85-6/86

## ARGO TUNNEL - WATER QUALITY DATA

Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> /Monitoring	Comment
Total Cadmium (µg/L)	RI-II	121.5	120 - 123	2				6/89, 9/89
Total Cadmium (µg/L)	SWSR	178		1				4/92
Chromium 6+ (µg/L)	OU1-FS	4.6	0.0 - 18.6	4		16/11	OM	7/85-6/86
Dis. Chromium (µg/L)	76/77	9	0.0 - 20	14		984/117	M 1st Y	
Dis. Chromium (µg/L)	OU1-FS	27	16 - 53	5				7/85-6/86
Dis. Chromium (µg/L)	RI-II	107	0.0 - 214	2				6/89, 9/89
Total Chromium (µg/L)	76/77	16	0.0 - 30	14		50	M 1st Y	
Total Chromium (µg/L)	OU1-FS	26	0.0 - 62	5				7/85-6/86
Total Chromium (µg/L)	RI-II	114	0.0 - 229	2				6/89, 9/89
Total Chromium (µg/L)	SWSR	18		1				4/92
Dis. Cobalt (µg/L)	OU1-FS	179	133 - 318	5			N	7/85-6/86
Total Cobalt (µg/L)	OU1-FS	171	122 - 296	5			N	7/85-6/86
Total Cobalt (µg/L)	SWSR	158		1				4/92

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Com- ment
Dis. Copper (µg/L)	76/77	5600	4300 - 6400	14		6.5/17	L,M	
Dis. Copper (µg/L)	OUI-FS	5685	4580 - 6720	5				7/85- 6/86
Dis. Copper (µg/L)	RI-II	4940	4780 - 5100	2				6/89, 9/89
Total Copper (µg/L)	76/77	5800	5000 - 6500	14		200	L,M	
Total Copper (µg/L)	OUI-FS	5410	4100 - 6290	5				7/85- 6/86
Total Copper (µg/L)	RI-II	4840	4780 - 4900	2				6/89, 9/89
Total Copper (µg/L)	RD	7760	5400-13000	10				
Total Copper (µg/L)	SWSR	6580		1				4/92
Total Cyanide (µg/L)	OUI-FS	0.0		2		5	OM	d.
Dis. Iron (mg/L)	76/77	166	160 - 190	14		0.3	L,M	
Dis. Iron (mg/L)	OUI-FS	159	137 - 204	5				7/85- 6/86
Dis. Iron (mg/L)	RI-II	113	97 - 130	2				6/89, 9/89
Total Iron (mg/L)	76/77	179	160 - 200	13		1.0	L,M	
Total Iron (mg/L)	OUI-FS	155	132 - 197	6				7/85- 6/86
Total Iron (mg/L)	RI-II	115	100 - 130	2				6/89, 9/89
Total Iron (mg/L)	RD	186	130 - 328	10				

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> /Monitoring	Comment
Total Iron (mg/l)	SWSR	189		1				4/92
Dis. Lead (µg/L)	76/77	29	15 - 40	14		31/1.5	L,M	
Dis. Lead (µg/L)	OU1-FS	111	11 - 292	5				7/85-6/86
Dis. Lead (µg/L)	RI-II	9		1				6/89
Total Lead (µg/L)	76/77	77	<100 - 200	14		50	L,M	
Total Lead (µg/L)	OU1-FS	100	17 - 262	5				7/85-6/86
Total Lead (µg/L)	RI-II	8		1				
Total Lead (µg/L)	SWSR	18.9		1				4/92
Dis. Manganese (mg/L)	76/77	93	82 - 120	14		0.050	L,M	
Dis. Manganese (mg/L)	OU1-FS	100	77.7 - 149	5				7/85-6/86
Dis. Manganese (mg/L)	RI-II	76.4	73 - 79.9	2				
Total Manganese (mg/L)	76/77	94	80 - 110	14		1.0	L,M	
Total Manganese (mg/L)	OU1-FS	95	78.6 - 140	5				7/85-6/86
Total Manganese (mg/L)	RI-II	77	74 - 79.9	2				6/89, 9/89
Total Manganese (mg/L)	SWSR	128		1				4/92
Total Manganese (mg/l)	RD	102	76 - 134	10				
Dis. Mercury (µg/L)	76/77	0.0	0.0 - 0.2	14		0.1/2.4	M 1st Y	f.

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Comment
Dis. Mercury (µg/L)	OU1-FS	0.0		5				7/85-6/86
Total Mercury (µg/L)	76/77	0.0	0.0 - 0.2	14		0.01	M 1st Y	
Total Mercury (µg/L)	OU1-FS	0.0		5				7/85-6/86
Total Mercury (µg/L)	SWSR	0.0		1				4/92
Dis. Molybdenum (µg/L)	76/77	0	0 - 2	14			N	
Dis. Molybdenum (µg/L)	OU1-FS	0.0		3				7/85-10/85
Dis. Molybdenum (µg/L)	RI-II	0.0		2				6/89, 9/89
Total Molybdenum (µg/L)	76/77	0.5	0 - 2	14			N	
Total Molybdenum (µg/L)	OU1-FS	0.0		3				7/85-10/85
Total Molybdenum (µg/L)	RI-II	0.0		2				6/89, 9/89
Dis. Nickel (µg/L)	OU1-FS	309	187 - 628	5		56/545	L,M	7/85-6/86
Dis. Nickel (µg/L)	RI-II	278	260 - 297	2				6/89, 9/89
Total Nickel (µg/L)	OU1-FS	295	191 - 610	5		100	L,M	7/85-6/86
Total Nickel (µg/L)	RI-II	288	270 - 307	2				6/89, 9/89

Table A-1: LIMITATION EVALUATION

November 24, 1997

Argo ACD  
Page A1-8

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Com-ment
Total Nickel (µg/L)	SWSR	240		1				4/92
Dis. Selenium (µg/L)	76/77	0	0	14		5/20	M 1st Y	a.
Dis. Selenium (µg/L)	OU1-FS	0		5				7/85-6/86
Total Selenium (µg/L)	76/77	0	0	14		20	M 1st Y	
Total Selenium (µg/L)	OU1-FS	0.0		5				7/85-6/86
Total Selenium (µg/L)	SWSR	0.0		1				4/92
Dis. Silver (µg/L)	76/77	0	0	14		0.02/0.62	L,M	
Dis. Silver (µg/L)	OU1-FS	3.2	0.0 - 8.4	4				7/85-6/86
Dis. Silver (µg/L)	RI-II	0.0	-	1				6/89
Total Silver (µg/L)	76/77	11	<10 - 60	14		100	see diss.	
Total Silver (µg/L)	OU1-FS	48.7	0.0 - 145	5				7/85-6/86
Total Silver (µg/L)	RI-II	0.0	-	1				6/89
Total Silver (µg/L)	SWSR	0.0		1				4/92
Dis. Strontium (µg/L)	OU1-FS	1247	1020 - 1390	3			N	7/85-10/85
Total Strontium (µg/L)	OU1-FS	1198	947 - 1340	3			N	7/85-6/86

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Comment
Dis. Thallium (µg/L)	OU1-FS	2	0.0 - 10	5		15	M 1st Y	7/85-6/86
Total Thallium (µg/L)	OU1-FS	2	0.0 - 10	5		0.5	M 1st Y	7/85-6/86
Total Thallium (µg/L)	SWSR	0.0		1				4/92
Dis. Tin (µg/L)	OU1-FS	3.4	0.0 - 17	5			N	7/85-6/86
Total Tin (µg/L)	OU1-FS	6.8	0.0 - 34	5			N	7/85-6/86
Dis. Vanadium (µg/L)	OU1-FS	9.8	0.0 - 40	5			N	7/85-6/86
Total Vanadium (µg/L)	OU1-FS	5.0	0.0 - 25	5			N	7/85-6/86
Total Vanadium (µg/L)	SWSR	0.0		1				4/92
Dis. Zinc (µg/L)	76/77	44,000	40,000-50,000	13		65.0/58.9	L,M	
Dis. Zinc (µg/L)	OU1-FS	58,770	42,500 - 116,000	5				7/85-6/86
Dis. Zinc (µg/L)	RI-IA	44,400		1				4/87
Dis. Zinc (µg/L)	RI-II	41,150	41,000-41,300	2				6/89, 9/89
Total Zinc (µg/L)	76/77	44,500	40,000-49,000	14		200	L,M	
Total Zinc (µg/L)	OU1-FS	55,450	37,800-108,000	5				7/85-6/86

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Comment
Total Zinc (µg/L)	RI-IA	43,500		1				4/87
Total Zinc (µg/L)	RI-II	41,700	41,400-42,000	2				6/89, 9/89
Total Zinc (µg/L)	RD	52,900	41,000-75,500	10				
Total Zinc (µg/L)	SWSR	54,600		1				4/92
Radium	no data						M 1st Y	
Total Uranium	no data						M 1st Y	
Gross Alpha	no data						M 1st Y	
Dis. Sulfate (mg/L)	76/77	2010	1900 - 2300	13		250	M 1st Y	c.
Sulfate (mg/L)	OU1-FS	2032	1028 - 2560	4				
Sulfate (mg/L)	RI-II	2045	2020 - 2070	2				
Fluoride (mg/l)	OU1-FS	2.4	1.3 - 3.5	5		2.0	M 1st Y	
Fluoride (mg/l)	RI-II	3.5		1				
Chloride (mg/l)	OU1-FS	6.3	0.0 - 25.0	5		250	M 1st Y	
Chloride (mg/l)	RI-II	9.4		1				
Phosphate (mg/l)	no data							
Phosphorous (mg/l)	RI-II	.08		1			M 1st Y	e.
Nitrite (mg/l)	no data					0.05	M 1st Y	
Nitrate (mg/l)	RI-II	< .01		1			OM	d.

ARGO TUNNEL - WATER QUALITY DATA								
Parameter	Data Source	Average <sup>1</sup>	Range	# of Samples	Treated <sup>3</sup> WaterQual	Triggers <sup>4</sup>	Limits <sup>2</sup> / Monitoring	Com- ment
Nitrate/Nitrite (mg/l)	76/77	0.02	0 - .22	12		10		
Nitrate/Nitrite (mg/l)	OU1-FS	0.06	0.0 - 0.28	4				
Whole Effluent Toxicity (Ceriodaphnia)	RI-II	LC-50 = 0.14%		1			L,M	6/89
Whole Effluent Toxicity (Fathead minnows)	RI-II	LC-50 = 0.65%		1			L,M	6/89

Data Sources for ARGO Tunnel Upstream & Downstream Data

76/77 USGS data March 11, 1976 - March 18, 1977. Pre-blow-out conditions.

OU1-FS Superfund data (CDM) four samples taken between July 1985 and June 1986. Feasibility Study Report OU 1 Argo Tunnel Discharge Control, August 1, 1988, from Table 1-1.

RI-IA Final draft Remedial Investigation Report Addendum, samples taken in April 1987, (January 1988).

RI-II Superfund data June 13, 1989 and September 19, 1989 from Clear Creek Phase II Remedial Investigation, September 21, 1990.

SWSR Surface Water Sampling Report, samples taken in April 1992, (1994).

UCCWA Upper Clear Creek Watershed Association.

START EPA - Superfund START Program contract.

RD CDPHE - Data collected for Remedial Design.

NOTES

- 1 Averaged using zero for values below the detection limits.
- 2
  - L,M - Limit and monitoring for Parameter
  - M - Monitoring Only
  - OM - Occasional Monitoring
  - M 1stY- Monitor 1st Year
  - N - No Limits or Monitoring
- 3 No data to date on Argo Treatment performance.
- 4 Triggers are water quality criteria, standards or advisories.

COMMENTS

- a. Selenium - Selenium confirm date w/more recent monitoring.
- b. Aluminum - Possible limit or may control with WET limits as was done at Climax Urad.
- c. Sulfate - WLA needed.
- d. Nitrate & Cyanide - Indicators of mining activity, especially new activity affecting Argo water quality. Nitrate also of concern to Standley Lake users.
- e. Phosphorous - Basin concern for Standley Lake users.

TABLE A-2: UPSTREAM QUALITY

CLEAR CREEK - UPSTREAM QUALITY (CC-25) - MAINSTEM ABOVE WEST FORK (1994 - 1996)							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
Flow (cfs)	UCCWA	173	13 - 791	16			
pH (s.u.)	UCCWA	7.68	7.26 - 8.33	24	6.5 - 9.0		
Diss. Solids (mg/l)	no data						
Dis. Aluminum ( $\mu\text{g/l}$ )	UCCWA	34.4	<10 - 67	23	750 (ac) 87 (ch)		
Total Aluminum ( $\mu\text{g/l}$ )	UCCWA	200	<10 - 1651	22			
Dis. Antimony ( $\mu\text{g/l}$ )	UCCWA	0.0	<40 - <50	9			
Total Antimony ( $\mu\text{g/l}$ )	UCCWA	0.0	<40 - <50	8			
Dis. Arsenic ( $\mu\text{g/l}$ )	UCCWA	31.5	0.8 - 50	22	360 (ac) 150 (ch)		
Total Arsenic ( $\mu\text{g/l}$ )	UCCWA	31.5	0.8 - 50	22	100 (ch) TR		
Dis. Barium ( $\mu\text{g/l}$ )	UCCWA	36.0	22.5 - 50.6	8			
Total Barium ( $\mu\text{g/l}$ )	UCCWA	37.8	23.4 - 55.6	8			
Dis. Beryllium ( $\mu\text{g/l}$ )	UCCWA	1.4	1 - 2.0	9			
Total Beryllium ( $\mu\text{g/l}$ )	UCCWA	1.4	1 - 2.0	9			
Dis. Cadmium ( $\mu\text{g/l}$ )	UCCWA	0.24	<0.5 - 1.2	23	TVS (ac (tr)), ch		
Total Cadmium ( $\mu\text{g/l}$ )	UCCWA	1.7	<0.5 - 27	22	10 (ch)		

CLEAR CREEK - UPSTREAM QUALITY (CC-25) - MAINSTEM ABOVE WEST FORK (1994 - 1996)							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
Dis. Calcium (mg/l)	UCCWA	14.3	6.96 - 22.22	18			
Total Calcium (mg/l)	UCCWA	15.8	13.1 - 19.3	7			
Dis. Chromium ( $\mu$ g/l)	UCCWA	4.5	4.0 - 5.0	10	TVS Cr III (ac, ch)		
Total Chromium ( $\mu$ g/l)	UCCWA	4.6	4.0 - 5.7	9	100 TRec		
Chromium 6+ ( $\mu$ g/l)	no data				TVS Cr 6+ (ac, ch)		
Dis. Cobalt ( $\mu$ g/l)	UCCWA	0.0	<5 - <6.0	9			
Total Cobalt ( $\mu$ g/l)	UCCWA	0.0	<5 - 6.0	8			
Dis. Copper ( $\mu$ g/l)	UCCWA	0.3	<0.5 - 1.8	23	TVS (ac, ch)		
Total Copper ( $\mu$ g/l)	UCCWA	2.5	1.0 - 12	22	200 TRec		
Dis. Iron ( $\mu$ g/l)	UCCWA	35.7	<5 - 98.4	23			
Total Iron ( $\mu$ g/l)	UCCWA	330	141 - 1458	22	1000 TRec		
Dis. Lead ( $\mu$ g/l)	UCCWA	9.5	0.8 - 40	23	TVS (ac, ch)		
Total Lead ( $\mu$ g/l)	UCCWA	11.6	0.8 - 40	22			
Dis. Magnesium (mg/l)	UCCWA	4.6	2.08 - 7.17	18			
Total Magnesium (mg/l)	UCCWA	5.2	4.01 - 6.0	7			

TABLE A-2: UPSTREAM QUALITY

CLEAR CREEK - UPSTREAM QUALITY (CC-25) - MAINSTEM ABOVE WEST FORK (1994 - 1996)							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
Dis. Manganese ( $\mu\text{g/l}$ )	UCCWA	23.1	11.2 - 45.2	23			
Total Manganese ( $\mu\text{g/l}$ )	UCCWA	35.8	17 - 84	22	1000 TRec		
Dis. Molybdenum ( $\mu\text{g/l}$ )	UCCWA	7.1	5.0 - 8	10			
Total Molybdenum ( $\mu\text{g/l}$ )	UCCWA	7.1	5.0 - 8	10			
Dis. Nickel ( $\mu\text{g/l}$ )	UCCWA	1.0	6.9 - 16	23	TVS (ac, ch)		
Total Nickel ( $\mu\text{g/l}$ )	UCCWA	0.0	<5.0 - <15.0	22	200 TRec		
Dis. Potassium (mg/l)	UCCWA	1.4	<0.65 - 2.46	9			
Total Potassium (mg/l)	UCCWA	1.7	1.00 - 2.20	4			
Dis. Selenium ( $\mu\text{g/l}$ )	UCCWA	37.1	1 - 85	22	5/20		
Total Selenium ( $\mu\text{g/l}$ )	UCCWA	37.1	1 - 85	22	20 (ch)		
Dis. Sodium (mg/l)	UCCWA	4.2	1.92 - 9.35	9			
Total Sodium (mg/l)	UCCWA	3.9	2.89 - 5.20	4			
Dis. Silver ( $\mu\text{g/l}$ )	UCCWA	2.5	0.2 - 5	20	TVS (ac) TVS (ch(tr))	eff. 3/2/98	
Total Silver ( $\mu\text{g/l}$ )	UCCWA	2.3	0.2 - 5	19			
Dis. Thallium ( $\mu\text{g/l}$ )	UCCWA	60.1	50 - 85.0	9	15 (ch)		

CLEAR CREEK - UPSTREAM QUALITY (CC-25) - MAINSTEM ABOVE WEST FORK (1994 - 1996)							
Total Thallium ( $\mu\text{g/l}$ )	UCCWA	60.1	50 - 85.0	9	0.5 TRec		
Dis. Vanadium ( $\mu\text{g/l}$ )	UCCWA	0.0	<4.0	8			
Total Vanadium ( $\mu\text{g/l}$ )	UCCWA	0.0	<4.0	8			
Dis. Zinc ( $\mu\text{g/l}$ )	UCCWA	217	64 - 447	23	TVS (ac)		
Total Zinc ( $\mu\text{g/l}$ )	UCCWA	242	92 - 484	22	200 (ch)		
Dis. Phosphorous (mg/l)	UCCWA	0.0089	0.00125 - 0.0373	22			
Total Phosphorous (mg/l)	UCCWA	0.0191	0.0051 - 0.0490	21			
Chloride (mg/l)	UCCWA	10.7	2.0 - 23.0	11			
Ammonia-N (mg/l)	UCCWA	0.06	0.005 - 0.26	23	TVS (ac) 0.02 (ch)		
Nitrate/Nitrite (mg/l)	UCCWA	0.21	0.11 - 0.37	23	NO2 0.05 NO3 100		
Hardness (mg/l) (dis.)	UCCWA	63.3	25.7 - 264	16			
Hardness (mg/l) (tot.)	UCCWA	43.6	26.2 - 69	3			

CLEAR CREEK - UPSTREAM QUALITY (SW-07) - 150 METERS BELOW CHICAGO CREEK							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
Flow (cfs)	RI-II	111		1			9/89
Flow (cfs)	START	87.5		1			
pH (s.u.)	OU1-FS	6.75		4	6.5 - 9.0		
pH (s.u.)	RI-II	6.85	6.5 - 7.2	2			6/89, 9/89
pH (s.u.)	START	7.62		1			
Diss. Solids (mg/l)	RI-II	56.0		1			6/89
Dis. Aluminum ( $\mu\text{g/l}$ )	OU1-FS	174		4	750/87		
Dis. Aluminum ( $\mu\text{g/l}$ )	RI-II	0.0	<120 - <500	2			6/89, 9/89
Dis. Aluminum ( $\mu\text{g/l}$ )	START	81		1			
Total Aluminum ( $\mu\text{g/l}$ )	OU1-FS	237		4			
Total Aluminum ( $\mu\text{g/l}$ )	RI-II/ RD	220	<0.05 - 670	11			
Total Aluminum ( $\mu\text{g/l}$ )	START	150		1			
Dis. Arsenic ( $\mu\text{g/l}$ )	OU1-FS	4.75		4	360/150		
Dis. Arsenic ( $\mu\text{g/l}$ )	RI-II	0.0	<1.0 - <10.0	2			6/89, 9/89
Dis. Arsenic ( $\mu\text{g/l}$ )	START	<0.8		1			

TABLE A-2: UPSTREAM QUALITY

CLEAR CREEK - UPSTREAM QUALITY (SW-07) - 150 METERS BELOW CHICAGO CREEK							
Total Arsenic ( $\mu\text{g/l}$ )	OU1-FS	4.75		4	100 TRec		
Total Arsenic ( $\mu\text{g/l}$ )	RI-II	0.0	<1.0 - <10.0	2			6/89, 9/89
Total Arsenic ( $\mu\text{g/l}$ )	START	<0.8		1			
Dis. Cadmium ( $\mu\text{g/l}$ )	OU1-FS	4		4	TVS (ac (tr), ch)		
Dis. Cadmium ( $\mu\text{g/l}$ )	RI-II	0.0	<14.0 - <25.0	2			6/89, 9/89
Dis. Cadmium ( $\mu\text{g/l}$ )	START	0.60		1			
Total Cadmium ( $\mu\text{g/l}$ )	OU1-FS	4		4	10 (ch)		
Total Cadmium ( $\mu\text{g/l}$ )	RI-II	0.0	<14.0 - <25.0	2			6/89, 9/89
Total Cadmium ( $\mu\text{g/l}$ )	START	1.10		1			
Dis. Calcium (mg/l)	RI-II	10.1	9.3 - 10.8	2			6/89, 9/89
Total Calcium (mg/l)	START	14.3		1			
Total Calcium (mg/l)	RI-II	10.0	9.2 - 10.0	2			6/89, 9/89
Dis. Chromium ( $\mu\text{g/l}$ )	OU1-FS	5.00		4	TVS (ac, ch)		
Dis. Chromium ( $\mu\text{g/l}$ )	RI-II	0.0	<23.0 - <50.0	2			6/89, 9/89
Total Chromium ( $\mu\text{g/l}$ )	OU1-FS	5.00		4	100 TRec		

CLEAR CREEK - UPSTREAM QUALITY (SW-07) - 150 METERS BELOW CHICAGO CREEK							
Total Chromium ( $\mu\text{g/l}$ )	RI-II	0.0	<23.0 - <50.0	2			6/89, 9/89
Chromium 6+ ( $\mu\text{g/l}$ )	no data						
Dis. Copper ( $\mu\text{g/l}$ )	OU1-FS	10		4	TVS (ac, ch)		
Dis. Copper ( $\mu\text{g/l}$ )	RI-II	11.5	23.0 - <50.0	2			6/89, 9/89
Dis. Copper ( $\mu\text{g/l}$ )	START	13		1			
Total Copper ( $\mu\text{g/l}$ )	OU1-FS	17		4	200 TRec		
Total Copper ( $\mu\text{g/l}$ )	RI-II/ RD	15.0	3.5 - 28	11			
Total Copper ( $\mu\text{g/l}$ )	START	18		1			
Dis. Iron ( $\mu\text{g/l}$ )	START	96		1			
Dis. Iron ( $\mu\text{g/l}$ )	RI-II	105	30.0 - 180	2			6/89, 9/89
Total Iron ( $\mu\text{g/l}$ )	RI-II/ RD	298	130 - 740	11	1000 TRec		
Total Iron ( $\mu\text{g/l}$ )	START	269		1			
Dis. Lead ( $\mu\text{g/l}$ )	OU1-FS	3.00		4	TVS (ac, ch)		
Dis. Lead ( $\mu\text{g/l}$ )	RI-II	0.0	<5.00	1			6/89
Dis. Lead ( $\mu\text{g/l}$ )	START	<0.8		1			
Total Lead ( $\mu\text{g/l}$ )	OU1-FS	5.38		4	100 TRec		

TABLE A-2: UPSTREAM QUALITY

CLEAR CREEK - UPSTREAM QUALITY (SW-07) - 150 METERS BELOW CHICAGO CREEK							
Total Lead ( $\mu\text{g/l}$ )	RI-II	0.0	<5.00	2			6/89
Total Lead ( $\mu\text{g/l}$ )	START	2.7		1			
Dis Magnesium (mg/l)	RI-II	2.84	2.20 - 3.47	2			6/89, 9/89
Total Magnesium ( $\mu\text{g/l}$ )	RI-II	2.83	2.10 - 3.55	2			6/89, 9/89
Total Magnesium ( $\mu\text{g/l}$ )	START	4.37		1			
Dis. Manganese ( $\mu\text{g/l}$ )	OU1-FS	938		4			
Dis. Manganese ( $\mu\text{g/l}$ )	RI-II	514	467 - 570	2			6/89, 9/89
Dis. Manganese ( $\mu\text{g/l}$ )	START	196		1			
Total Manganese ( $\mu\text{g/l}$ )	OU1-FS	929		4	1000 TRec		
Total Manganese ( $\mu\text{g/l}$ )	RI-II/ RD	291	96 - 610	11			
Total Manganese ( $\mu\text{g/l}$ )	START	207		1			
Dis. Nickel ( $\mu\text{g/l}$ )	OU1-FS	15		4	TVS (ac, ch)		
Dis. Nickel ( $\mu\text{g/l}$ )	RI-II	23.5	47.0 - <50.0	2			6/89, 9/89
Dis. Nickel ( $\mu\text{g/l}$ )	START	<10		1			
Total Nickel ( $\mu\text{g/l}$ )	OU1-FS	10		4	200 TRec		
Total Nickel ( $\mu\text{g/l}$ )	RI-II	25.0	50.0 - <50.0	2			6/89, 9/89

TABLE A-2: UPSTREAM QUALITY

CLEAR CREEK - UPSTREAM QUALITY (SW-07) - 150 METERS BELOW CHICAGO CREEK							
Total Nickel ( $\mu\text{g/l}$ )	START	<10		1			
Dis. Selenium ( $\mu\text{g/l}$ )	no data				20 (ac) 5 (ch)		
Total Selenium ( $\mu\text{g/l}$ )	no data				20 (ch)		
Total Sodium (mg/l)	RI-II	6.6	5.3 - 7.91	2			6/89, 9/89
Dis. Sodium (mg/l)	START	10.5		1			
Total Sodium (mg/l)	RI-II	6.04	4.2 - 7.87	2			6/89, 9/89
Dis. Zinc ( $\mu\text{g/l}$ )	OU1-FS	246		4	TVS (ac)		
Dis. Zinc ( $\mu\text{g/l}$ )	RI-II	218	200 - 236	2			6/89, 9/89
Dis. Zinc ( $\mu\text{g/l}$ )	START	214		1			
Total Zinc ( $\mu\text{g/l}$ )	OU1-FS	252		4	200 (ch)		
Total Zinc ( $\mu\text{g/l}$ )	RI-II/ RD	315	73 - 760	11			6/89, 9/89
Total Zinc ( $\mu\text{g/l}$ )	START	240		1			
Dis. Silver ( $\mu\text{g/l}$ )	OU1-FS	2.30		4	TVS (ac) TVS (ch(tr))	Eff. 3/2/98	
Dis. Silver ( $\mu\text{g/l}$ )	RI-II	0.0	<25.0	1			6/89

TABLE A-2: UPSTREAM QUALITY

CLEAR CREEK - UPSTREAM QUALITY (SW-07) - 150 METERS BELOW CHICAGO CREEK							
Dis. Silver ( $\mu\text{g/l}$ )	START	<0.2		1			
Total Silver ( $\mu\text{g/l}$ )	OU1-FS	2.30		4			
Total Silver ( $\mu\text{g/l}$ )	RI-II	0.0	<25.0	1			6/89
Total Silver ( $\mu\text{g/l}$ )	START	<0.2		1			
Dis. Phosphate ( $\text{mg/l}$ )	START	<0.04		1			
Total Phosphate ( $\text{mg/l}$ )	no data						
Sulfate ( $\text{mg/l}$ )	RI-II	19.2	13.3 - 25.2	2			6/89, 9/89
Sulfate ( $\text{mg/l}$ )	OU1-FS	36		4			
Sulfate ( $\text{mg/l}$ )	START	31.1		1			
Chloride ( $\text{mg/l}$ )	RI-II	2.0	4.0 - <5.0	2			6/89, 9/89
Chloride ( $\text{mg/l}$ )	START	6.06		1			
Ammonia-N ( $\text{mg/l}$ )	START	<0.05		1	TVS (ac) 0.02 (ch)		
Nitrate ( $\text{mg/l}$ )	RI-II	0.04		1	100		9/89
Nitrate/Nitrite ( $\text{mg/l}$ )	START	0.14		1	0.05 - NO2		
Fluoride ( $\text{mg/l}$ )	OU1-FS	0.76		4			
Fluoride ( $\text{mg/l}$ )	RI-II	0.56		1			6/89
Fluoride ( $\text{mg/l}$ )	START	0.69		1			
Hardness ( $\text{mg/l}$ )	START	53.7		1			

CLEAR CREEK - UPSTREAM QUALITY (SW-07A) - BELOW VIRGINIA CANYON							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
Flow (cfs)	RD						
Total Aluminum ( $\mu\text{g/l}$ )	RD	253	<0.05 - 916	14			
Total Copper ( $\mu\text{g/l}$ )	RD	22.6	3.7 - 101	14			
Total Iron ( $\mu\text{g/l}$ )	RD	321	130 - 835	14			
Total Manganese ( $\mu\text{g/l}$ )	RD	461	97 - 1120	14			
Total Zinc ( $\mu\text{g/l}$ )	RD	310	83 - 758	14			

CLEAR CREEK - DOWNSTREAM QUALITY (SW-05) - 50 METERS BELOW ARGO							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
Flow (cfs)	RI-II	110		1			9/89
Flow (cfs)	START	94		1			
pH (s.u.)	OU1-FS	6.02		4	6.5 - 9.0		
pH (s.u.)	RI-II	6.75	6.5 - 7.0	2			6/89, 9/89
pH (s.u.)	START	7.84		1			
Diss. Solids (mg/l)	RI-II	65.0		1			6/89
Dis. Aluminum (µg/l)	OU1-FS	219		4	750/87		
Dis. Aluminum (µg/l)	RI-II	0.0	<120 - <500	2			6/89, 9/89
Dis. Aluminum (µg/l)	START	<40		1			
Total Aluminum (µg/l)	OU1-FS	958		4			
Total Aluminum (µg/l)	RI-II/ RD	686	<0.05 - 2350	16			
Total Aluminum (µg/l)	START	410		1			
Dis. Arsenic (µg/l)	OU1-FS	4.75		4	360/150		
Dis. Arsenic (µg/l)	RI-II	0.0	<1.0 - <10.0	2			6/89, 9/89
Dis. Arsenic (µg/l)	START	<0.8		1			

Table A-3: DOWNSTREAM QUALITY

CLEAR CREEK - DOWNSTREAM QUALITY (SW-05) - 50 METERS BELOW ARGO							
Total Arsenic ( $\mu\text{g/l}$ )	OU1-FS	4.75		4	50 Trec		
Total Arsenic ( $\mu\text{g/l}$ )	RI-II	0.0	<1.0 - <10.0	2			6/89, 9/89
Total Arsenic ( $\mu\text{g/l}$ )	START	<0.8		1			
Dis. Cadmium ( $\mu\text{g/l}$ )	OU1-FS	6		4	TVS ac(tr) 3(ch)		
Dis. Cadmium ( $\mu\text{g/l}$ )	RI-II	0.0	<14.0 - <25.0	2			6/89, 9/89
Dis. Cadmium ( $\mu\text{g/l}$ )	START	2.00		1			
Total Cadmium ( $\mu\text{g/l}$ )	OU1-FS	4		4	5(ac)		
Total Cadmium ( $\mu\text{g/l}$ )	RI-II	0.0	<14.0 - <25.0	2			6/89, 9/89
Total Cadmium ( $\mu\text{g/l}$ )	START	2.50		1			
Dis. Calcium (mg/l)	RI-II	10.4	8.9 - 11.8	2			6/89, 9/89
Total Calcium (mg/l)	START	16.4		1			
Total Calcium (mg/l)	RI-II	10.7	9.2 - 12.2	2			6/89, 9/89
Dis. Chromium ( $\mu\text{g/l}$ )	OU1-FS	5.25		4	TVS CrIII		
Dis. Chromium ( $\mu\text{g/l}$ )	RI-II	0.0	<23.0 - <50.0	2			6/89, 9/89
Total Chromium ( $\mu\text{g/l}$ )	OU1-FS	5.00		4	50 (ac)		
Total Chromium ( $\mu\text{g/l}$ )	RI-II	0.0	<23.0 - <50.0	2			6/89, 9/89
Chromium 6+ ( $\mu\text{g/l}$ )	no data				16/11		

CLEAR CREEK - DOWNSTREAM QUALITY (SW-05) - 50 METERS BELOW ARGO							
Dis. Copper ( $\mu\text{g/l}$ )	OU1-FS	57		4	TVS (ac), 17 ch		
Dis. Copper ( $\mu\text{g/l}$ )	RI-II	8.5	17.0 - <50.0	2			6/89, 9/89
Dis. Copper ( $\mu\text{g/l}$ )	START	14		1			
Total Copper ( $\mu\text{g/l}$ )	OU1-FS	158		4	200 Trec 1000 (ch)		
Total Copper ( $\mu\text{g/l}$ )	RI-II/ RD	114	0.0078 - 567	16			
Total Copper ( $\mu\text{g/l}$ )	START	71		1			
Dis. Iron ( $\mu\text{g/l}$ )	START	28		1	300 (ch)		
Dis. Iron ( $\mu\text{g/l}$ )	RI-II	135	<30.0 - 270	2			6/89, 9/89
Total Iron ( $\mu\text{g/l}$ )	RI-II/ RD	2950	120 - 17000	16	1000 TRec		
Total Iron ( $\mu\text{g/l}$ )	START	1480		1			
Dis. Lead ( $\mu\text{g/l}$ )	OU1-FS	3.00		4	TVS (ac, ch)		
Dis. Lead ( $\mu\text{g/l}$ )	RI-II	0.0	<5.00	1			6/89
Dis. Lead ( $\mu\text{g/l}$ )	START	<0.8		1			
Total Lead ( $\mu\text{g/l}$ )	OU1-FS	7.18		4	50 TRec		
Total Lead ( $\mu\text{g/l}$ )	RI-II	0.0	<5.00	1			6/89
Total Lead ( $\mu\text{g/l}$ )	START	2.9		1			

Table A-3:

## DOWNSTREAM QUALITY

Argo ARD  
Page A3-4

CLEAR CREEK - DOWNSTREAM QUALITY (SW-05) - 50 METERS BELOW ARGO							
Dis Magnesium (mg/l)	RI-II	2.71	2.20 - 3.22	2			6/89, 9/89
Total Magnesium (mg/l)	RI-II	2.95	2.10 - 3.80	2			6/89, 9/89
Total Magnesium (mg/l)	START	5.31		1			
Dis. Manganese ( $\mu\text{g/l}$ )	OU1-FS	3521		4	50 (ch)		
Dis. Manganese ( $\mu\text{g/l}$ )	RI-II	544	448 - 640	2			6/89, 9/89
Dis. Manganese ( $\mu\text{g/l}$ )	START	858		1			
Total Manganese ( $\mu\text{g/l}$ )	OU1-FS	34678		4	1000 TRec		
Total Manganese ( $\mu\text{g/l}$ )	RI-II/ RD	2044	170 - 12200	16			6/89, 9/89
Total Manganese ( $\mu\text{g/l}$ )	START	860		1			
Dis. Nickel ( $\mu\text{g/l}$ )	OU1-FS	13		4	TVS (ac, ch)		
Dis. Nickel ( $\mu\text{g/l}$ )	RI-II	0.0	<12.0 - <50.0	2			6/89, 9/89
Dis. Nickel ( $\mu\text{g/l}$ )	START	<10		1			
Total Nickel ( $\mu\text{g/l}$ )	OU1-FS	14		4	100 TRec		
Total Nickel ( $\mu\text{g/l}$ )	RI-II	0.0	<12.0 - <50.0	2			6/89, 9/89
Total Nickel ( $\mu\text{g/l}$ )	START	<10		1			

CLEAR CREEK - DOWNSTREAM QUALITY (SW-05) - 50 METERS BELOW ARGO							
Dis. Selenium ( $\mu\text{g/l}$ )	no data				20 (ac) 5 (ch)		
Total Selenium ( $\mu\text{g/l}$ )	no data				10 (ch)		
Dis. Sodium (mg/l)	RI-II	6.16	4.2 - 8.12	2			
Dis. Sodium (mg/l)	START	10.3		1			
Total Sodium (mg/l)	RI-II	5.98	3.8 - 8.15	2			6/89, 9/89
Dis. Zinc ( $\mu\text{g/l}$ )	OU1-FS	1565		4	TVS (ac) 300 (ch)		
Dis. Zinc ( $\mu\text{g/l}$ )	RI-II	201	161 - 240	2			6/89, 9/89
Dis. Zinc ( $\mu\text{g/l}$ )	START	538		1			
Total Zinc ( $\mu\text{g/l}$ )	OU1-FS	1560		4	2000 (ch)		
Total Zinc ( $\mu\text{g/l}$ )	RI-II/ RD	1073	100 - 5570	16			6/89, 9/89
Total Zinc ( $\mu\text{g/l}$ )	START	625		1			
Dis. Silver ( $\mu\text{g/l}$ )	OU1-FS	2.30		4	TVS (ac) TVS (ch)	Eff. 3/2/98	
Dis. Silver ( $\mu\text{g/l}$ )	RI-II	0.0	<25.0	1			6/89
Dis. Silver ( $\mu\text{g/l}$ )	START	<0.2		1			

Table A-3: DOWNSTREAM QUALITY

CLEAR CREEK - DOWNSTREAM QUALITY (SW-05) - 50 METERS BELOW ARGO							
Total Silver ( $\mu\text{g/l}$ )	OU1-FS	2.30		4	100 (ac)		
Total Silver ( $\mu\text{g/l}$ )	RI-II	0.0	<25.0	1			6/89
Total Silver ( $\mu\text{g/l}$ )	START	<0.2		1			
Dis. Phosphate (mg/l)	START	<0.04		1			
Total Phosphate (mg/l)	no data						
Sulfate (mg/l)	RI-II	26.9	17.3 - 36.5	2	250		6/89, 9/89
Sulfate (mg/l)	OU1-FS	97		4			
Sulfate (mg/l)	START	43.2		1			
Chloride (mg/l)	RI-II	1.85	3.7 - <5.0	2	250		6/89, 9/89
Chloride (mg/l)	START	5.63		1			
Ammonia-N (mg/l)	START	<0.05		1	TVS (ac) 0.02 (ch)		
Nitrate (mg/l)	RI-II	0.39		1	10		9/89
Nitrate/Nitrite (mg/l)	START	0.13		1	0.05 NO2		
Fluoride (mg/l)	OU1-FS	0.70		4	2.0 (ac)		
Fluoride (mg/l)	RI-II	0.56		1			6/89
Fluoride (mg/l)	START	0.69		1			
Hardness (mg/l)	START	62.8		1			

CLEAR CREEK - DOWNSTREAM QUALITY (STORET 000132) - BELOW IDAHO SPRINGS (1/86 - 7/95)							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
pH (s.u.)	ID SPGS	7.5	6.5 - 8.6	104			
Ammonia-N (mg/l)	ID SPGS	0.07	<0.1 - 0.53	103			
Total Hardness (mg/l)	ID SPGS	84.7	24 - 160	105			
Dis. Cadmium ( $\mu$ g/l)	ID SPGS	1.7	0.4 - 8	77			
Total Cadmium ( $\mu$ g/l)	ID SPGS	2.6	<0.3 - 7	30			
Dis. Copper ( $\mu$ g/l)	ID SPGS	15.7	8 - 56	77			
Total Copper ( $\mu$ g/l)	ID SPGS	91	18 - 270	21			
Dis. Iron ( $\mu$ g/l)	ID SPGS	143	14 - 1200	41			
Total Iron ( $\mu$ g/l)	ID SPGS	1265	12 - 6170	57			
Dis. Lead ( $\mu$ g/l)	ID SPGS	0.04	<1 - 3	68			
Total Lead ( $\mu$ g/l)	ID SPGS	1.3	<5 - 8	30			
Dis. Manganese ( $\mu$ g/l)	ID SPGS	1080	150 - 2600	77			

Table A-3: DOWNSTREAM QUALITY

CLEAR CREEK - DOWNSTREAM QUALITY (STORET 000132) - BELOW IDAHO SPRINGS (1/86 - 7/95)							
Dis. Mercury ( $\mu\text{g/l}$ )	ID SPGS	0.0	<0.02 - <0.02	28			
Dis. Zinc ( $\mu\text{g/l}$ )	ID SPGS	408	110 - 1100	77			
Total Zinc ( $\mu\text{g/l}$ )	ID SPGS	698	150 - 2550	30			

Table A-3: DOWNSTREAM QUALITY

CLEAR CREEK - DOWNSTREAM QUALITY (CC-40) - MAINSTEM BELOW IDAHO SPRINGS (1994 - 1996)							
Parameter	Data Source	Average	Range	# of Samples	Triggers	Limits/ Monitoring	Comment
Flow (cfs)	UCCWA	439	30 - 1700	16			
pH (s.u.)	UCCWA	7.59	7.23 - 7.90	23			
Diss. Solids (mg/l)	no data						
Dis. Aluminum ( $\mu\text{g/l}$ )	UCCWA	46.2	<30 - 113	22	750 (ac) 87 (ch)		
Total Aluminum ( $\mu\text{g/l}$ )	UCCWA	915	114 - 5663	21			
Dis. Antimony ( $\mu\text{g/l}$ )	UCCWA	0.0	<40 - <50	8	6.0 (ws)		
Total Antimony ( $\mu\text{g/l}$ )	UCCWA	0.0	<40 - <50	7			
Dis. Arsenic ( $\mu\text{g/l}$ )	UCCWA	30.6	0.8 - 50	21	360/150		
Total Arsenic ( $\mu\text{g/l}$ )	UCCWA	30.8	1 - 50	21	50 TRec		
Dis. Barium ( $\mu\text{g/l}$ )	UCCWA	26.1	17.3 - 33.6	7			
Total Barium ( $\mu\text{g/l}$ )	UCCWA	29.3	20.8 - 36.2	7			
Dis. Beryllium ( $\mu\text{g/l}$ )	UCCWA	1.5	1 - 2.0	8			
Total Beryllium ( $\mu\text{g/l}$ )	UCCWA	1.5	1 - 2.0	8			
Dis. Cadmium ( $\mu\text{g/l}$ )	UCCWA	1.2	<0.5 - 5.8	22	TVS(ac(tr) , 3 ch		
Total Cadmium ( $\mu\text{g/l}$ )	UCCWA	1.8	0.5 - 6.0	21	5 (ac)		

Table A-3: DOWNSTREAM QUALITY

CLEAR CREEK - DOWNSTREAM QUALITY (CC-40) - MAINSTEM BELOW IDAHO SPRINGS (1994 - 1996)							
Dis. Calcium (mg/l)	UCCWA	16.7	6.58 - 26.51	17			
Total Calcium (mg/l)	UCCWA	18.6	13.1 - 23.02	7			
Dis. Chromium ( $\mu\text{g/l}$ )	UCCWA	4.4	4.0 - 5.0	9	TVS Cr III (ac, ch)		
Total Chromium ( $\mu\text{g/l}$ )	UCCWA	4.4	4.0 - 5.0	8			
Chromium 6+ ( $\mu\text{g/l}$ )	no data				16/11		
Dis. Cobalt ( $\mu\text{g/l}$ )	UCCWA	0.0	<5 - <6.0	8			
Total Cobalt ( $\mu\text{g/l}$ )	UCCWA	0.0	<5 - <6.0	7			
Dis. Copper ( $\mu\text{g/l}$ )	UCCWA	10.9	2.7 - 29.8	22	17 (ch)		
Total Copper ( $\mu\text{g/l}$ )	UCCWA	49.0	10.9 - 164.8	21	200 Trec 1000 (ch)		
Dis. Iron ( $\mu\text{g/l}$ )	UCCWA	50.4	<4.0 - 173	22	300 (ch)		
Total Iron ( $\mu\text{g/l}$ )	UCCWA	2084	336 - 12907	21	1000 (ch)		
Dis. Lead ( $\mu\text{g/l}$ )	UCCWA	8.3	0.8 - 40	22	TVS (ac, ch)		
Total Lead ( $\mu\text{g/l}$ )	UCCWA	13.2	1.1 - 59.5	21	50 TRec		
Dis Magnesium (mg/l)	UCCWA	4.76	1.77 - 7.13	17			
Total Magnesium (mg/l)	UCCWA	5.5	3.78 - 6.75	5			

Table A-3: DOWNSTREAM QUALITY

CLEAR CREEK - DOWNSTREAM QUALITY (CC-40) - MAINSTEM BELOW IDAHO SPRINGS (1994 - 1996)							
Dis. Manganese ( $\mu\text{g/l}$ )	UCCWA	673	97.1 - 1585	22	50 (ch)		
Total Manganese ( $\mu\text{g/l}$ )	UCCWA	796	210.2 - 1766	21	1000 (ch)		
Dis. Molybdenum ( $\mu\text{g/l}$ )	UCCWA	8.3	5.0 - 16	9			
Total Molybdenum ( $\mu\text{g/l}$ )	UCCWA	9.0	5.4 - 14	9			
Dis. Nickel ( $\mu\text{g/l}$ )	UCCWA	0.97	5.2 - 10	22	TVS (ac, ch)		19/22 no detects >10 $\mu\text{g/l}$
Total Nickel ( $\mu\text{g/l}$ )	UCCWA	0.25	5.3 - <15.0	21	100 (ch)		1 detect
Dis. Phosphorous (mg/l)	UCCWA	0.00562	0.00125 - 0.0187	21			
Total Phosphorous (mg/l)	UCCWA	0.03224	0.0066 - 0.0747	20			
Dis. Potassium (mg/l)	UCCWA	2.5	1.1 - 4.0	8			
Total Potassium (mg/l)	UCCWA	2.4	1.55 - 3.30	4			
Dis. Selenium ( $\mu\text{g/l}$ )	UCCWA	36.5	1 - 85.0	21	20 (ac) 5 (ch)		
Total Selenium ( $\mu\text{g/l}$ )	UCCWA	38.5	1 - 85.0	21	10 (ch)		
Dis. Silver ( $\mu\text{g/l}$ )	UCCWA	2.3	0.2 - 5	19	TVS (ac) TVS (ch)	Eff. 3/2/98	
Total Silver ( $\mu\text{g/l}$ )	UCCWA	2.2	0.2 - 5	18	100 (ws)		

CLEAR CREEK - DOWNSTREAM QUALITY (CC-40) - MAINSTEM BELOW IDAHO SPRINGS (1994 - 1996)							
Dis Sodium (mg/l)	UCCWA	14.8	6.14 - 25.99	8			
Total Sodium (mg/l)	UCCWA	13.8	9.46 - 19.6	4			
Dis. Thallium (µg/l)	UCCWA	61.4	1.3 - 85	8	15 (ac)		
Total Thallium (µg/l)	UCCWA	61.4	1.3 - 85	8	0.5 (wb)		
Dis. Vanadium (µg/l)	UCCWA	0.0	<4.0	7			
Total Vanadium (µg/l)	UCCWA	0.0	<4.0	7			
Dis. Zinc (µg/l)	UCCWA	376	101.6 - 1118	22	TVS (ac) 300 (ch)		
Total Zinc (µg/l)	UCCWA	523	155.0 - 1379	21	2000 (ch)		
Chlorides (mg/l)	UCCWA	9.64	1.0 - 13.8	10			
Ammonia -N (mg/l)	UCCWA	0.048	0.005 - 0.38	21	TVS (ac) 0.02 (ch)		
Nitrate/Nitrite (mg/l)	UCCWA	0.25	0.12 - 0.52	21	NO2 0.05 NO3 10.0		
Total Kjeldahl Nitrogen (mg/l)	UCCWA	0.15	0.05 - 0.25	8			
Total Hardness (mg/l)	UCCWA	47.2	35.6 - 78.0	3			
Dis. Hardness (mg/l)	UCCWA	55.1	23.7 - 95.6	14			

Table A-4  
Interim Effluent Limits Argo Tunnel Discharge

Parameter	Effluent Limit		Rationale
	30-Day Avg.	Daily Max	
Flow, mgd	N/A	1.008	Design Capacity
TSS, mg/l	20	30	Effluent Guidelines
pH, s.u.	N/A	6.0 - 9.0	Effluent Guidelines
Oil and Grease, mg/l	N/A	10	State Effluent Regulations
Copper (TR), mg/l	0.15	0.30	Effluent Guidelines
Zinc (TR), mg/l	0.75	1.5	Effluent Guidelines
Lead (TR), mg/l	0.3	0.6	Effluent Guidelines
Cadmium (TR), mg/l	0.05	0.10	Effluent Guidelines
Whole Effluent Toxicity, Acute	N/A	N/A	State Discharge Regulations

(1) If a visible sheen or floating oil is observed at the discharge point, a sample shall be taken and analyzed.

Table A  
Potential ARAR Water Quality Standards  
(All in  $\mu\text{g}$  unless noted below)

November 24, 1997 Page 15-1

Parameter	Aquatic Life Table Value Standards (Dissolved) <sup>(2)</sup>		Ambient - Based Site Specific Std. <sup>(1)</sup> (Total Recoverbl.)	Water Supply (Total Recoverable)	Agricultural (Total Recoverable)	Recreation Class I	Water + Fish (Dissolved)
	Acute	Chronic	Chronic	Acute / Chronic	Chronic	--	Chronic
Aluminum	750	87		-- / --	--	--	--
Antimony	--	--		-- / 6.0	--	--	6
Arsenic	360	150		50 <sup>(1)</sup> / --	100	--	--
Barium	--	--		1000 / --	--	--	--
Beryllium	--	--		-- / 4.0	100	--	--
Cadmium (6)	1.8	0.66	3(TRec) <sup>(1)</sup>	5 / --	10	--	--
Chromium III	984	117		50 / -- <sup>(1)</sup>	100	--	--
Chromium VI	16 <sup>(1)</sup>	11 <sup>(1)</sup>		50 / --	100	--	--
Copper (6)	9.2	6.5	17(TRec) <sup>(1)</sup>	-- / 1000	200	--	--
Iron	--	1000 (TRec) <sup>(1)</sup>		-- / 300 (dis) <sup>(1)</sup>	--	--	--
Lead (6)	31.3 <sup>(1)</sup>	1.5 <sup>(1)</sup>		50 / --	100	--	--
Manganese	--	1000 (TRec) <sup>(1)</sup>		-- / 50 (dis) <sup>(1)</sup>	200	--	--
Mercury	2.4	.01(tot.) <sup>(1)</sup>		2.0 / --	--	--	--
Nickel (6)	545 <sup>(1)</sup>	56.4 <sup>(1)</sup>		-- / 100	200	--	--
Selenium	20	5	10 (TRec) <sup>(1)</sup>	-- / 50	20	--	--
Silver (6)	0.62 <sup>(1)</sup>	0.02 <sup>(1)</sup>		100 / --	--	--	--
Thallium	--	15		-- / 0.5	--	--	0.5
Uranium (6)	1200	700		--	--	--	--
Zinc (6)	65	59	300(TRec)	-- / 5000	2000	--	--

**Table A-5**  
**Potential ARAR Water Quality Standards**  
 (All in  $\mu\text{g}$  unless noted below)

November 24, 1997 Page A5-2

Parameter	Aquatic Life Table Value Standards (Dissolved) <sup>(2)</sup>		Ambient - Based Site Specific Stnd. <sup>(1)</sup> (Total Recoverbl.)	Water Supply (Total Recoverable)	Agricultural (Total Recoverable)	Recreation Class I	Water + Fish (Dissolved)
	Acute	Chronic	Chronic	Acute / Chronic	Chronic	--	Chronic
Ammonia <sup>(3)</sup> as N. (unionized)	TVS <sup>(1,4)</sup>	0.02 <sup>(1)</sup>		-- / 0.5	--	--	--
Cyanide - Free <sup>(3)</sup>	0.005 <sup>(1)</sup>			0.2 / --	0.2 (acute)	--	--
Fecal Coliform <sup>(5)</sup>	--	--		--	--	200 <sup>(1)</sup>	--
D O <sup>(3)</sup>	6.0 <sup>(1)</sup> 7.0(sp)	--		--	--	--	--
pH (s.u.)	6.5- 9.0 <sup>(1)</sup>						
Fluoride <sup>(3)</sup>	--	--		20 / --	--	--	--
Sulfate <sup>(3)</sup>	--	--		-- / 250 <sup>(1)</sup>	--	--	--
Chloride <sup>(3)</sup>	--	--		-- / 250 <sup>(1)</sup>	--	--	--
Nitrate <sup>(3)</sup>	--	--		10 / -- <sup>(1)</sup>	100	--	--
Nitrite <sup>(3)</sup>	--	--		1.0 / -- <sup>(1)</sup>	10 (acute)	--	--

Foot Notes for Table A-5.

- (1) WQS applied to Segment 11.
- (2) Table Value Standards (TVS) based on hardness of 50 mg/l as CaCO<sub>3</sub>.
- (3) mg/l.
- (4) 0.43/FT/FPH/2
- (5) no./100 ml.
- (6) TVS are hardness based. TVS increase with hardness.

Table A-6  
Water Quality Standard Based Effluent Limits

Oct. 20, 1997

Parameter	Criteria	Criteria Source	Method of Analysis	Q1 Upstream Low Flow (CFS)	C1 Upstream Concentration (SW-QT) (ug/l)	Q3 Q1 + Q2 (CFS)	C3 Stream Standard (ug/l)	C2 Effluent Limit (ug/l)
Aluminum	acute	basic TVS	dissolved	29	174	30.56	750	11458
	chronic	basic TVS	dissolved	34	174	35.56	87	-1809
Antimony	chronic	water suppl	TRec	34	0	35.56	6	137
Arsenic	acute	basic TVS	dissolved	29	31.5	30.56	360	6467
	chronic	basic TVS	dissolved	34	4.75	35.56	150	3316
	acute	Sg11 WQS	TRec	29	31.5	30.56	50	394
	chronic	agricult	TRec	34	4.75	35.56	100	2176
Beryllium	chronic	water suppl	TRec	34	1.4	35.56	4	61
Cadmium	acute	TVS	dissolved	29	4	30.56	1.8	-39
	chronic	TVS	dissolved	34	0.5	35.56	0.66	4.1
	acute	water suppl	TRec	29	4	30.56	5	24
	chronic	Sg11 SSS	TRec	34	1.5	35.56	3	36
Cr III	acute	TVS	dissolved	29	5	30.56	984	19183
	chronic	TVS	dissolved	34	5	35.56	117	2558
	acute	water suppl	TRec	29	5	30.56	50	887
	chronic	agricult	TRec	34	5	35.56	100	2171
Cr VI	acute	TVS	dissolved	29	0	30.56	16	313
	chronic	TVS	dissolved	34	0	35.56	11	251
	acute	water suppl	TRec	29	0	30.56	50	979
	chronic	agricult	TRec	34	0	35.56	100	2279
Copper	acute	TVS	dissolved	29	11.5	30.56	9.2	-34
	chronic	TVS	dissolved	34	11.5	35.56	6.5	-102
	chronic	Sg11 SSS	TRec	34	16	35.56	17	39
Iron	chronic	WQS	TRec	34	321	35.56	1000	15799
	chronic	2nd MCL	dissolved	34	100	35.56	300	4659
Lead	acute	TVS	dissolved	29	3	30.56	31.3	557
	chronic	TVS	dissolved	34	3	35.56	1.5	-31
	acute	water suppl	TRec	29	4	30.56	50	905
	chronic	agricult	TRec	34	4	35.56	100	2192

Table A-6  
Water Quality Standard Based Effluent Limits

Oct. 20, 1997

Parameter	Criteria	Criteria Source	Method of Analysis	Q1 Upstream Low Flow (CFS)	Q1 Upstream Concentration (SV-07) (ug/l)	Q1 + Q2 (CFS)	Q2 Stream Standard (ug/l)	Q2 Effluent Limit (ug/l)
Manganese	chronic	2nd MCL	dissolved	34	500	35.56	50	-9758
	chronic	WQS	TRec	34	500	35.56	200	-6338
	chronic	h health	TRec	34	500	35.56	800	7338
Mercury	acute	basic TVS	dissolved	29	0	30.56	2.4	47
	acute	water suppl	TRec	29	0	30.56	2	39
	chronic	WQS	Total	34	0	35.56	0.01	0.23
Nickel	acute	TVS	dissolved	29	20	30.56	545	10305
	chronic	TVS	dissolved	34	20	35.56	56.4	850
	chronic	water suppl	Trec	34	20	35.56	100	1844
Selenium	acute	water suppl	dissolved	29	0	30.56	20	392
	chronic	basic TVS	dissolved	34	0	35.56	5	114
	chronic	WQS	TRec	34	0	35.56	10	228
Silver	acute	TVS	dissolved	29	1	30.56	0.62	-6
	chronic	TVS	dissolved	34	1	35.56	0.02	-21
	acute	water suppl	TRec	29	1	30.56	100	1940
Thallium	chronic	water suppl	Trec	34	0	35.56	0.5	11
	chronic	basic TVS	dissolved	34	0	35.56	15	342
Uranium	acute	basic TVS	dissolved	29	0	30.56	1200	23508
	chronic	basic TVS	dissolved	34	0	35.56	700	15956
Zinc	acute	TVS	dissolved	29	250	30.56	65	-3374
	chronic	TVS	dissolved	29	250	30.56	59	-3492
	chronic	Sg11 SSS	TRec	34	250	35.56	300	1390
Sulfate	chronic	water suppl	dissolved	34	30	35.56	250	5045
Chloride	chronic	water suppl	dissolved	34	4	35.56	250	5612
Fluoride	acute	water suppl	dissolved	34	0.65	35.56	2	31

TABLE A-7

Oct. 20, 1997 Page 1

## METALS TRANSLATOR EVALUATION

Clear Creek Watershed Data 1994 - 1996			Site CC-49 (Downstream of Idaho Springs)						
Date	Al(T)	Al(d)	Al(d)/Al(T)	Cd(T)	Cd(d)	Cd(d)/Cd(T)	Pb(T)	Pb(d)	Pb(d)/Pb(T)
02/07/94								40	
04/05/94	324	48	0.148	4	4	1.000	40	40	1.000
05/26/94	390	82	0.210	4	4	1.000	40	40	1.000
07/11/94	173	33	0.191	4	4	1.000	40	40	1.000
08/16/94	251	59.4	0.237	1	0.8	0.800	10.2	1.4	0.137
10/12/94	326	51.7	0.159	1.4	1.1	0.786	2	1.4	0.700
12/08/94	212	40	0.189	1.8	1.5	0.833	1.8	1.4	0.778
02/06/95	314	30	0.096	2	1.2	0.600	1.1	0.8	0.727
04/04/95	287	43	0.150	1.5	1.1	0.733	3	1	0.333
05/25/95	2240	55	0.025	6	5.8	0.967	12.1	0.8	0.066
06/14/95	5663	88	0.016	3.5	1.1	0.314	59.5	0.8	0.013
07/10/95	3516	113	0.032	0.9	0.5	0.556	26.8	1.1	0.041
08/15/95	339	61	0.180	1.5	1	0.667	2.1	0.8	0.381
10/11/95	334	51.1	0.153	2.9	2.3	0.793	2	1.4	0.700
12/07/95	826	49	0.059	3.8	3	0.789	1.2	0.8	0.667
04/02/96	1383	55	0.040	4.5	3.2	0.711	8.9	0.8	0.090
05/23/96	743	68	0.092	0.5	0.5	1.000	5.7	0.8	0.140
06/19/96	199	63	0.317	0.6	0.5	0.833	2.3	0.8	0.348
07/15/96	1063	40	0.038	0.8	0.5	0.625	10.4	0.8	0.077
08/20/96	309	33.9	0.110	1.2	0.95	0.792	4.8	1.1	0.229
10/09/96	208	62	0.298	1.8	1.5	0.833	1.5	1.3	0.867
12/05/96	114	40	0.351	2.5	2.9	1.160	1.3	5.2	4.000
Geo.mean			0.109			0.774			0.316

TABLE A-7

Oct. 20, 1997 Page 2

## METALS TRANSLATOR EVALUATION

Clear Creek Watershed Data 1994 - 1996				Site CC-40 (Downstream of Idaho Springs)						
Date	Mn(I)	Mn(d)	Mn(d)/Mn(I)	Zn(I)	Zn(d)	Zn(d)/Zn(I)	Cu(I)	Cu(d)	Cu(d)/Cu(I)	155
02/07/94		830			462			10		
04/05/94	933	893	0.957	582	450	0.773	48	13	0.271	8
05/26/94	320	200	0.625	209	152	0.727	25	14	0.560	2
07/11/94	217	184	0.848	166	121	0.729	15	6	0.400	
08/16/94	432	393	0.910	272	169	0.621	21.4	8.2	0.383	16
10/12/94	701	600	0.856	584	319	0.546	37.1	7.4	0.199	6
12/08/94	943	917	0.972	586	457	0.780	31.5	5.7	0.181	4
02/06/95	1051	1070	1.018	623	447	0.717	50	10	0.200	6
04/04/95	882	831	0.942	485	333	0.687	41.8	7.9	0.189	3
05/25/95	1766	1585	0.898	1379	1118	0.811	148	29.8	0.201	30
06/14/95	1545	567	0.367	782	322	0.412	97	14.6	0.151	104
07/10/95	605	208	0.344	271	152	0.561	31	12	0.387	57
08/15/95	409	379	0.927	304	253	0.832	34	15	0.441	3
10/11/95	890	921	1.035	662	542	0.819	64.4	15.2	0.236	4
12/07/95	1467	1426	0.972	986	753	0.764	103	12	0.117	6
04/02/96	1409.9	1134	0.804	1167.1	611.4	0.524	164.8	8.8	0.053	9
05/23/96	328.9	151.8	0.462	199	127.9	0.643	10.9	6.9	0.633	8
06/19/96	210.2	97.1	0.462	155	101.6	0.655	12.5	5.9	0.472	11
07/15/96	367.1	151	0.411	182	116.2	0.638	13.6	2.7	0.199	22
08/20/96	384	330	0.859	273	175	0.641	25.1	4.2	0.167	1.5
10/09/96	599	609	1.017	415	356	0.858	32.5	11.2	0.345	12.5
12/05/96	1250	1320	1.056	698	740	1.060	22.6	19.5	0.863	3
Geo. mean			0.752			0.691			0.264	

Table A-8  
Metal Effluent Limit Comparison

October 20, 1997

Parameter	MT	Criteria	Standard basis	Method of Analysis	Calculated Effluent Limit (1) (ug/l)	Metals Translator Limit (2) TRec (ug/l)	Permit Limit (dissolved) (ug/l)	Monitoring Method	Permit Limit (TRec) (ug/l)	Monitoring Method
Aluminum		acute	dissolved	PD	11458	105119	11458	PD	110000	TRec
Metals Translr =	0.109	chronic	dissolved	PD	87	798	87	PD	798	TRec
Antimony		chronic	TRec	TRec	137	--	--	--	137	TRec
No MT										
Arsenic		acute	dissolved	PD	6487	--	6487	PD	--	--
No MT		chronic	dissolved	PD	3316	--	3316	PD	--	--
		acute	TRec	TRec	394	--	--	--	394	TRec
		chronic	TRec	TRec	2176	--	--	--	2176	TRec
Beryllium		chronic	TRec	TRec	61	--	--	--	61	TRec
No MT										
Cadmium		acute	dissolved	PD	1.8	2.3	1.8	PD	2.3	TRec
Metals Translr =	0.774	chronic	dissolved	PD	4.1	5.3	4.1	PD	5.3	TRec
		acute	TRec	TRec	24	--	--	--	--	--
		chronic	TRec	TRec	195	--	--	--	--	--
Cr III		acute	dissolved	PD	19183	--	19183	PD	--	--
No MT		chronic	dissolved	PD	2558	--	2558	PD	--	--
		acute	TRec	TRec	887	--	--	--	887	TRec
		chronic	TRec	TRec	2171	--	--	--	2171	TRec
Cr VI		acute	dissolved	dissolved	313	--	313	dissolved	--	
No MT		chronic	dissolved	dissolved	251	--	251	dissolved	--	
		acute	TRec	dissolved	979	--	--	--	979	dissolved
		chronic	TRec	dissolved	2279	--	--	--	2279	dissolved
Copper		acute	dissolved	PD	9.2	34.8	9.2	PD	34.8	TRec
Metals Translr =	0.264	chronic	dissolved	PD	6.5	24.6	6.5	PD	24.6	TRec
		chronic	TRec	TRec	39	--	--	--	--	--
Iron		chronic	TRec	TRec	15800	--	--	--	16801	TRec
Metals Translr =	0.019	chronic	dissolved	PD	4659	245210	4659	PD	--	--
Lead		acute	dissolved	PD	557	1762	557	PD	--	--
Metals Translr =	0.316	chronic	dissolved	PD	1.5	4.75	1.5	PD	4.75	TRec
		acute	TRec	TRec	905	--	--	--	905	TRec
		chronic	TRec	TRec	2192	--	--	--	--	--

Table A-8  
Metal Effluent Limit Comparison

October 20, 1997

Parameter	MT	Criteria	Standard basis	Method of Analysis	Calculated Effluent Limit (1) (ug/l)	Metals Translator Limit (2) TRec (ug/l)	Permit Limit (dissolved) (ug/l)	Monitoring Method	Permit Limit (TRec) (ug/l)	Monitoring Method
Manganese		chronic	dissolved	PD	50	66.5	50	PD	66.5	TRec
Metals Transltr = 0.752		chronic	TRec	TRec	200	—	—	—	—	—
Mercury		acute	dissolved	PD	47	—	47	PD	—	—
No MT		acute	TRec	TRec	39	—	—	—	39	TRec
		chronic	Total	Total	0.23	—	—	—	0.23	Total
Nickel		acute	dissolved	PD	10305	—	10305	PD	—	—
No MT		chronic	dissolved	PD	850	—	850	PD	—	—
		chronic	Trec	TRec	1844	—	—	—	1844	TRec
Selenium		acute	dissolved	PD	392	—	392	PD	—	—
No MT		chronic	dissolved	PD	114	—	114	PD	—	—
		chronic	TRec	TRec	228	—	—	—	228	TRec
Silver		acute	dissolved	PD	0.62	—	0.62	PD	—	—
No MT		chronic	dissolved	PD	0.02	—	0.02	PD	—	—
		acute	TRec	TRec	1940	—	—	—	1940	TRec
Thallium		chronic	Trec	TRec	11	—	—	—	11	TRec
No MT		chronic	dissolved	PD	342	—	342	PD	—	—
Uranium		acute	dissolved	PD	23508	—	23508	PD	—	—
No MT		chronic	dissolved	PD	15956	—	15956	PD	—	—
Zinc		acute	dissolved	PD	65	94.1	65	PD	94.1	TRec
Metals Transltr = 0.691		chronic	dissolved	PD	59	85.4	59	PD	85.4	TRec
		chronic	TRec	TRec	1390	—	—	—	—	—
Sulfate		chronic	dissolved	dissolved	5045	—	5045	dissolved	—	—
Chloride		chronic	dissolved	dissolved	5612	—	5612	dissolved	—	—
Fluoride		acute	dissolved	dissolved	31	—	31	dissolved	—	—

(1) Calculated values from Table 6 (Water Quality Standard Based Effluent Limits)

(2) Calculated metals translator values from Table 7 (Metals Translator Evaluation)

Table A-9  
Final Effluent Limits for Argo Tunnel Discharge

Parameter	Effluent Limit		Monitoring Frequency	Sample Type	Rationale
	30-Day Avg	Daily Max			
Flow, mgd	N/A	1.008 <sup>(1)</sup>	Daily	Inst.	Design Capacity
TSS, mg/l	20	30	Weekly	24-hr Comp	Best Professional Judgement, ELG
pH, s.u.	N/A	6.5 - 9.0	Daily	Grab or Inst.	Water Quality Standards
Oil and Grease, mg/l	N/A	10	Daily, Visual	Grab <sup>(1)</sup>	State Effluent Regulations
Arsenic (TRec.), µg/l	N/A	400	Weekly	24-hr Comp	Water Quality Standards
Cadmium (TRec.), µg/l	3	N/A	Weekly	24-hr Comp	Water Quality Standards, BPJ
Copper (TRec), mg/l	17	35	Weekly	24-hr Comp	Water Quality Standards, MT, BPJ
Iron (TRec), µg/l	15800	N/A	Weekly	24-hr Comp	Water Quality Standards
Lead (TRec), µg/l	4.75	905	Weekly	24-hr Comp	Water Quality Standards, MT
Manganese, (TRec.) µg/l	800	N/A	Weekly	24-hr Comp	Human Health Protection, BPJ
Nickel (TRec.), µg/l	850	N/A	Weekly	24-hr Comp	Water Quality Standards
Silver (TRec.), µg/l	0.02	0.62	Weekly	24-hr Comp	Water Quality Standards
Zinc (TRec.), µg/l	225	N/A	Weekly	24-hr Comp	B. Trout Protection, BPJ
Hardness, mg/l as CaCO <sub>3</sub>	N/A	N/A	Weekly	24-hr Comp	N/A
Whole Effluent Toxicity, Acute	N/A	(2)	Quarterly	Grab	State Discharge Regulations

(1) If a visible sheen or floating oil is observed at the discharge point, a sample shall be taken and analyzed.

(2) LC<sub>50</sub> > 100% at any effluent concentration tested.

(3) Reevaluate discharge limits if capacity exceeds 1.008 mgd.

Table A-10 First Year - Treatment Plant Influent and Effluent Monitoring

Influent and Effluent Monitoring Requirements - First Year after start-up *							
Parameter	Effluent	Monitoring Frequency	Rationale	Influent	Monitoring Frequency	Rationale	Sample Type
Flow, mgd	✓	Daily / Continuous	Limit	✓	Daily / Continuous	Perform, Indicator	Instantaneous
pH, s.u.	✓	Daily/ Continuous	Limit	✓	Daily/ Continuous	Indicator	Grab / Instantaneous
Oil and Grease, mg/l	✓	Weekly	Limit, Indicator				Daily Visual
TSS, mg/l	✓	Weekly	Limit, Perform				24-hr. Composite
Hardness, mg/l as CaCO <sub>3</sub>	✓	Weekly	Metals WQS				24-hr. Composite
Whole Effluent Toxicity, Acute	✓	Quarterly	Limit				Grab
Aluminum (TRec.), µg/l	✓	Weekly	Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Arsenic (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Cadmium (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Copper (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Iron (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Lead (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Manganese, (Trec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Nickel (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Silver (TRec.), µg/l	✓	Bi-Monthly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite
Zinc (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Bi-Monthly	Perform, Indicator	24-hr. Composite

Table A-10 First Year - Treatment Plant Influent and Effluent Monitoring

Influent and Effluent Monitoring Requirements - First Year after start-up *							
Parameter	Effluent	Monitoring Frequency	Rationale	Influent	Monitoring Frequency	Rationale	Sample Type
Beryllium (TRec), $\mu\text{g/l}$	✓	Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	24-hr. Composite
Chromium (TRec), $\mu\text{g/l}$	✓	Bi-Monthly	Add Info		Bi-Monthly	Add Info	24-hr. Composite
Chromium <sup>6+</sup> (Diss.), $\mu\text{g/l}$	✓	Bi-Monthly	Add Info		Bi-Monthly	Add Info	Grab
Mercury (Total), $\mu\text{g/l}$		Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	Grab
Selenium (TRec), $\mu\text{g/l}$		Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	24-hr. Composite
Thallium (TRec), $\mu\text{g/l}$		Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	24-hr. Composite
Uranium (Diss.), $\mu\text{g/l}$	✓	Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	24-hr. Composite
Radium 226 and Radium 228, PCi/l		Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	24-hr. Composite
Gross Alpha, PCi/l		Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	24-hr. Composite
Nitrate-N, mg/l	✓	Bi-Monthly	Indicator, Add Info	✓	Bi-Monthly	Indicator, Add Info	Grab
Nitrite-N, mg/l	✓	Bi-Monthly	Indicator, Add Info	✓	Bi-Monthly	Indicator, Add Info	Grab
Ammonia-N, mg/l	✓	Bi-Monthly	Add Info				
Cyanide, WAD $\mu\text{g/l}$				✓	Bi-Monthly	Indicator, Add Info	Grab
Total Phosphorous, mg/l	✓	Bi-Monthly	Add Info	✓	Bi-Monthly	Add Info	Grab
Chloride, mg/l	✓	Bi-Monthly	Add Info		Bi-Monthly	Add Info	24-hr. Composite
Fluoride, mg/l	✓	Bi-Monthly	Add Info		Bi-Monthly	Add Info	24-hr. Composite
Sulfate, mg/l	✓	Bi-Monthly	Add Info		Bi-Monthly	Add Info	24-hr. Composite

## Table A-10 First Year - Treatment Plant Influent and Effluent Monitoring

### Monitoring Rationale:

- Limit - Discharge Limit, ARAR compliance monitoring
- Perform - Data to be used to assess treatment plant performance, % removal, or technology based limits.
- Indicator - Indicator of changing conditions in mine drainage
- Add Info - Parameters needing additional information or of interest to watershed community

Bi-Monthly - Every other month (6 times per year)

- \* Monitoring may be modified over time. It is likely that the number of parameters and frequencies of monitoring will be reduced over time.

Table A-11

Influent and Effluent Monitoring Requirements - Second and Later Years *							
Parameter	Effluent	Frequency	Rationale	Influent	Frequency	Rationale	Sample Type
Flow, mgd	✓	Daily / Continuous	Limit	✓	Daily / Continuous	Perform, Indicator	Instantaneous/ Continuous
pH, s.u.	✓	Daily/ Continuous	Limit	✓	Daily/ Continuous	Indicator	Grab
Oil and Grease, mg/l	✓	Weekly	Limit, Indicator				Daily Visual
TSS, mg/l	✓	Weekly	Limit, Perform				24-hr. Composite
Hardness, mg/l as CaCO <sub>3</sub>	✓	Weekly	Metals WQS				24-hr. Composite
Whole Effluent Toxicity, Acute	✓	Quarterly	Limit				Grab
Aluminum (TRec.), µg/l	✓	Weekly	Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Arsenic (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Cadmium (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Copper (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Iron (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Lead (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Manganese, (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Nickel (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Silver (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Zinc (TRec.), µg/l	✓	Weekly	Limit, Perform	✓	Quarterly	Perform, Indicator	24-hr. Composite
Nitrate-N, mg/l				✓	Quarterly	Indicator	Grab
Nitrite-N, mg/l				✓	Quarterly	Indicator	Grab
Cyanide, WAD µg/l				✓	Quarterly	Indicator	Grab

Table A-12  
Clear Creek Instream Monitoring Requirements

Parameter	Upstream SW-07a	Downstream SW-05	Monitoring Frequency *		Sample Type
			Year 1	Year 2 & later	
Flow, cfs	✓	✓	Bi-Monthly	Quarterly	Grab
pH, s.u.	✓	✓	Bi-Monthly	Quarterly	Grab
Hardness, mg/l as CaCO <sub>3</sub>	✓	✓	Bi-Monthly	Quarterly	Grab
Alkalinity, mg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Aluminum (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Aluminum (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Arsenic (TRec.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Arsenic (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Cadmium (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Cadmium (Diss.) µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Copper (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Copper (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Iron (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Iron (Diss), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Lead (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Lead (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Manganese (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Manganese (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Nickel (TRec.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Nickel (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Silver (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Silver (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Zinc (TRec), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Zinc (Diss.), µg/l	✓	✓	Bi-Monthly	Quarterly	Grab

**Table A-12**  
**Clear Creek Instream Monitoring Requirements**

Parameter	Upstream SW-07a	Downstream SW-05	Monitoring Frequency *		Sample Type
			Year 1	Year 2 & later	
Total Phosphorous, mg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Nitrate-N, mg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Nitrate-N, mg/l	✓	✓	Bi-Monthly	Quarterly	Grab
Ammonia-N, mg/l	✓	✓	Bi-Monthly	Quarterly	Grab
The following parameters will not be monitored after the first year.					
Beryllium (TRec), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Beryllium (Diss), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Chromium (TRec), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Chromium (Diss), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Chromium <sup>6+</sup> (Diss), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Mercury (T), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Mercury (Diss.), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Selenium (TRec), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Selenium (Diss.), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Thallium (TRec), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Thallium (Diss.), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Uranium (Diss.), µg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Radium 226 and 228, pCi/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Gross Alpha, pCi/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Cyanide, WAD(Free), µg/l <sup>(1)</sup>	✓	✓	Bi-Monthly	Not Monitored	Grab
Sulfate, mg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Chloride, mg/l	✓	✓	Bi-Monthly	Not Monitored	Grab
Fluoride, mg/l	✓	✓	Bi-Monthly	Not Monitored	Grab

(1) Use ASTM D2306-81 Method C (weak acid dissociable) for cyanide monitoring.

\* Monitoring may be modified over time. It is likely that the number of parameters and frequencies of monitoring will be reduced over time.

OFFICIAL USE ONLY

-MKV



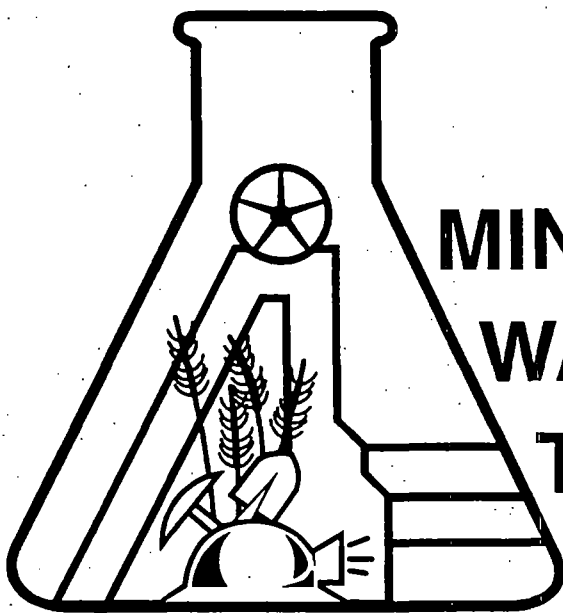
A MONTANA TECHNOLOGY COMPANY

contact: Mike Bishop for copies  
of reports (only cover pages  
enclosed)

Roger Wilmonyl (sp?) RTP-  
Cincinnati contact

FINAL REPORT—METAL ION  
REMOVAL FROM ACID MINE  
WASTEWATERS BY  
NEUTRAL-CHELATING POLYMERS:  
INITIAL INVESTIGATION  
AND MODELING STUDY

MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY IV, PROJECT 4



# MINE WASTE TECHNOLOGY PILOT PROGRAM

EPA

DOE

Montana Tech

Implemented by MSE, Inc.

**MSE, Inc.**

P.O. Box 4078 Butte, MT 59702 (406) 494-7100 FAX (406) 494-7230

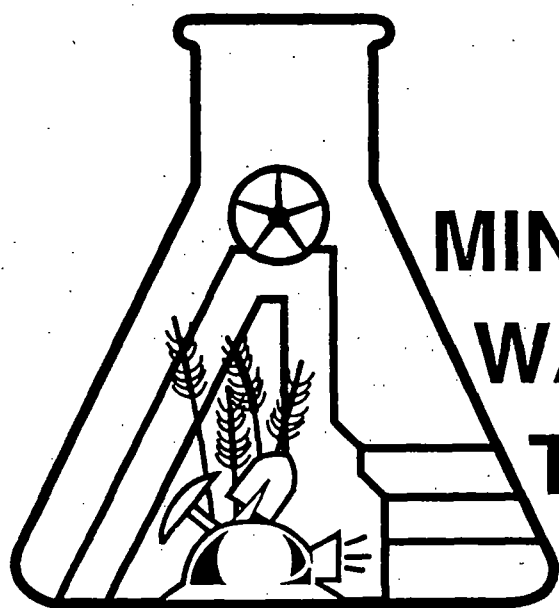
OFFICIAL USE ONLY

Recycled Cover



**FINAL REPORT—BERKELEY PIT INNOVATIVE  
TECHNOLOGIES PROJECTS: H.P.T. RESEARCH,  
INC., DEMONSTRATION**

**MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY IV, PROJECT 7**



# **MINE WASTE TECHNOLOGY PROGRAM**

**EPA    DOE    Montana Tech    Implemented by MSE Technology Applications, Inc.**

**MSE Technology Applications, Inc.**

**P.O. Box 4078 Butte, MT 59702 (406) 494-7100 FAX (406) 494-7230**

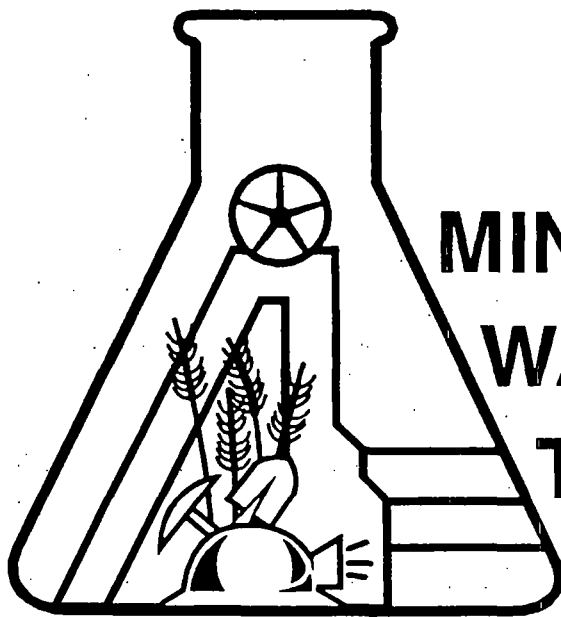
**OFFICIAL USE ONLY**



A MONTANA TECHNOLOGY COMPANY

**FINAL REPORT—PHOTOASSISTED ELECTRO-  
TRANSFER REACTIONS OF APPLICATION  
TO MINE WASTEWATER CLEANUP:  
NITRATE AND CYANIDE**

**MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY IV, PROJECT 3**



**MINE  
WASTE  
TECHNOLOGY  
PILOT PROGRAM**

EPA

DOE

Montana Tech

Implemented by MSE, Inc.

**MSE, Inc.**

P.O. Box 3767 Butte, MT 59702 (406) 494-7100 FAX (406) 494-7230

**OFFICIAL USE ONLY**



**FINAL REPORT—ARSENIC OXIDATION  
DEMONSTRATION PROJECT**

**MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY III, PROJECT 7**



**EPA   DOE   Montana Tech   Implemented by MSE Technology Applications, Inc.**

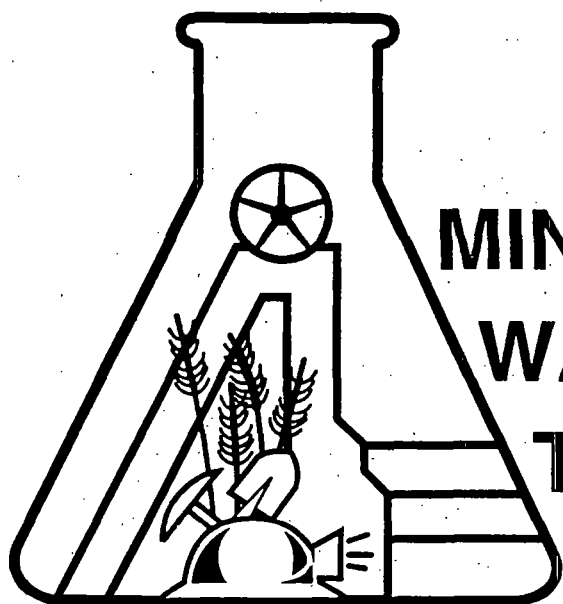
**MSE Technology Applications, Inc.**

**P.O. Box 4078   Butte, MT 59702   (406) 494-7100   FAX (406) 494-7230**



FINAL REPORT-NITRATE REMOVAL  
DEMONSTRATION PROJECT

MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY III, PROJECT 4



# MINE WASTE TECHNOLOGY PROGRAM

EPA DOE Montana Tech Implemented by MSE Technology Applications, Inc.

**MSE Technology Applications, Inc.**

P.O. Box 4078 Butte, MT 59702 (406) 494-7100 FAX (406) 494-7230

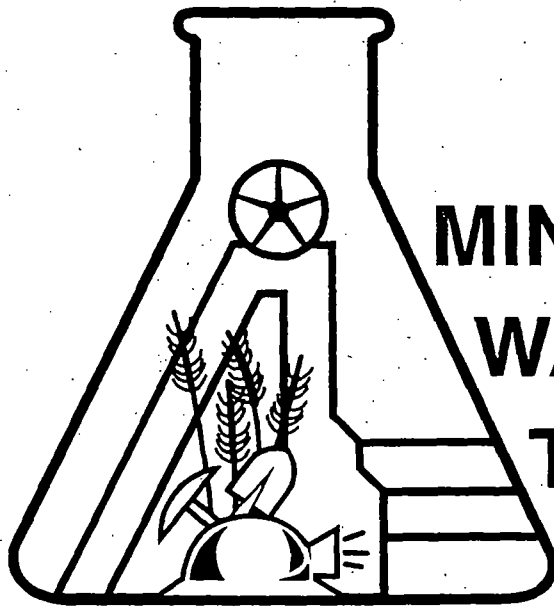
**OFFICIAL USE ONLY**



A MONTANA TECHNOLOGY COMPANY

**SUMMARY FINAL REPORT—CLAY-BASED  
GROUTING DEMONSTRATION PROJECT**

**MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY III, PROJECT 2**



**MINE  
WASTE  
TECHNOLOGY  
PILOT PROGRAM**

EPA

DOE

Montana Tech

Implemented by MSE, Inc.

**MSE, Inc.**

P.O. Box 4078 Butte, MT 59702 (406) 494-7100 FAX (406) 494-7230

**OFFICIAL USE ONLY**

Recycled Cover



**FINAL REPORT—REMOTE MINE SITE  
DEMONSTRATION PROJECT**

**MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY III, PROJECT 1**



# **MINE WASTE TECHNOLOGY PROGRAM**

**EPA    DOE    Montana Tech    Implemented by MSE Technology Applications, Inc.**

**MSE Technology Applications, Inc.**

**P.O. Box 4078 Butte, MT 59702 (406) 494-7100 FAX (406) 494-7230**

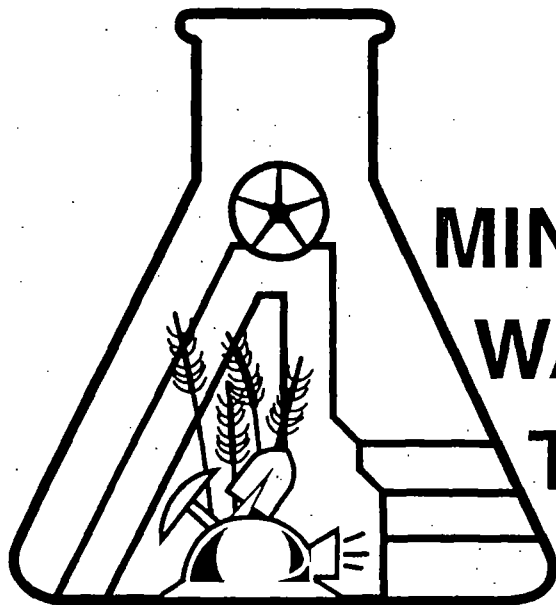
**OFFICIAL USE ONLY**



A MONTANA TECHNOLOGY COMPANY

**FINAL REPORT—BERKELEY PIT  
INNOVATIVE TECHNOLOGIES  
PROJECTS: GEO2 LIMITED  
DEMONSTRATION**

**MINE WASTE TECHNOLOGY PROGRAM  
ACTIVITY IV, PROJECT 7**



**MINE  
WASTE  
TECHNOLOGY  
PILOT PROGRAM**

**EPA**

**DOE**

**Montana Tech**

**Implemented by MSE, Inc.**

**MSE, Inc.**

**P.O. Box 4078 Butte, MT 59702 (406) 494-7100 FAX (406) 494-7230**

**OFFICIAL USE ONLY**

Recycled Cover

April 1997

# **Berkeley Pit Water Treatment Research Project Final Report**

March 1997

# **Final Report—Berkeley Pit Innovative Technologies Projects: SPC International and the Hebrew University of Jerusalem Demonstration**

**Demonstration performed by**

**SPC International, Inc.  
1000 Wilson Blvd.  
Arlington, Virginia 22209**

**and**

**The Hebrew University of Jerusalem  
Faculty of Agriculture  
P.O. Box 12  
Rehovot, Israel 76100**

**by**

**MSE Technology Applications, Inc.  
200 Technology Way  
P.O. Box 4078  
Butte, Montana 59702**

**and**

**Montana Tech of the University of Montana  
1300 W. Park Street  
Butte, Montana 59701**

March 1997

# **Final Report—Berkeley Pit Innovative Technologies Projects: Technical Assistance International, Inc., and the Group of Scientists Demonstration**

**Demonstration performed by**

Technical Assistance International, Inc.  
1320 Loma Verde Drive  
El Paso, Texas 79936

and

The Group of Scientists  
Moscow State University  
Vorobiev Gory  
Moscow, Russia 119899

**Demonstration date**

June 24 - July 12, 1996

March 1997

# Final Report—Berkeley Pit Innovative Technologies Projects: Purity Systems, Inc., and the University of Montana Demonstration

Demonstration performed by

David Pang  
Purity Systems, Inc.  
109 High Park Way  
Missoula, Montana 59803

and

Edward Rosenberg  
Professor, Department of Chemistry  
University of Montana  
Missoula, Montana 59812



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 10  
1200 Sixth Avenue  
Seattle, Washington 98101

APR 27 1998

Reply To  
Attn Of: OW-130

**MEMORANDUM**

SUBJECT: Review of Bunker Hill Long-Term Water Management Memorandum  
(Memorandum from CH2M Hill dated April 5, 1998)

FROM: Patty McGrath   
NPDES Permits Unit, Office of Water

TO: Mary Kay Voytilla  
Office of Environmental Cleanup

Following are my comments on the above-referenced memorandum and attachments. The comments are specific to each of the elements identified for evaluation in the memorandum. My review was limited by my limited background knowledge of the history and characteristics of the site. For example hydrology comments 3, 5, and 6, among others, suggest expanding the scope of the evaluation, which will not be necessary if the work suggested in these comments has already been done. Please feel free to contact me should you have questions regarding these comments.

**Bunker Hill Mine Hydrology**

(1) General Comment - mine maps and water balance: I agree with the main areas identified for evaluation. However, the first step should be to develop an accurate **map** of the underground workings including the relationship of the underground workings to surface features (e.g., surface waters). This is an important first step, as the map should be used as a basis for the elements identified for the hydrology evaluation (i.e., identifying AMD producing areas, flow paths, etc.), as well as for other issues (e.g., identifying potential disposal locations for CTP sludge). This might be what is meant by "Review existing maps" under the "General Technical Approach" on page 3. However, if existing maps are not adequate as a basis for the main elements identified for evaluation, then provision should be made to create a new map(s).

Also, an overall **water balance** around the mine should be developed. The mine map and water balance will provide a baseline for evaluating options for reducing and managing AMD, estimating mine water storage capacity, and estimating future CTP capacity requirements.

(2) Page 2, "Main Areas Identified for Evaluation", Item 1: The purpose given for identifying the highest AMD producing areas is to focus efforts on reduction of inflow. This implies that isolating high AMD areas from water is the proposed solution to reduce AMD production. CH2M Hill should also consider evaluating whether there are other ways of reducing the production of AMD, such as flooding (probably only applicable to certain portions of the mine) and backfilling. These considerations may change the focus of some of the technical approaches identified.

Should also consider expanding the purpose of Item 1 to include evaluation of the mechanisms of AMD production for the mine. Understanding the mechanisms will assist in predicting the effectiveness of potential solutions. For example, in some underground mines the AMD problem is exacerbated by fluctuating water levels (seasonal oxidation and flushing). Keeping the water level constant, even in high AMD producing areas, may reduce overall AMD production.

(3) General Comment on "Technical Approaches": Water management is focussed on evaluating the potential for reducing the water flowing **into** the mine workings (via surface diversions and plugging). CH2M Hill should also consider evaluating the feasibility and effectiveness of **in-mine** water diversion (e.g., use of underground barriers to, for example, subdivide different parts of the mine to control water levels/flow and/or isolate high AMD areas).

(4) Page 2, bullets under "Identify Highest AMD Areas": Existing information on the rock types and composition (geochemical and mineralogical properties) should also be used to help identify and evaluate the highest AMD producing areas.

(5) Page 2, Evaluate Surface Water Diversions: It is unclear what the source of the list of surface water diversions is. Should clarify whether the diversions listed are already in-place or are planned for the future. Add a dash stating the following: "Identify other potential areas for surface water diversions" (unless a decision has already been made to limit surface water diversions to the locations listed).

(6) Page 2, "Evaluate Mine Plugging Options": It is unclear what the source of the list of mine plugging options is. Add a dash stating the following: "Identify other potential locations for mine plugging/backfill" (unless a decision has already been made to limit the plugging to the locations listed). It is also unclear whether different types of plugs and/or backfill is being considered. The options listed should not be limited to just different locations, but should also look at the feasibility of different types of plugs.

(7) Page 3, "General Technical Approach": In the third dash, add "and locations" following "...of alternatives".

(8) Page 3, parenthesis following "Evaluate Structural Stability": Structural stability is also important to evaluate in terms of design, implementation, and maintenance of water diversions and mine plugs

### **Mine Contingency Plan**

#### **Evaluation of Existing Piping From Mine to CTP**

#### **Geotechnical Investigation of Reed Dump**

General Comment on these elements: These elements were presented in a minimal fashion; no comments, except that a time frame for each should be included.

### **Attachment A, Bunker Hill Central Treatment Plant (CTP) Upgrades Scoping**

(1) General Comment: The evaluation of the CTP focusses on upgrades necessary to meet future discharge limits. However, the current discharge from the CTP does not consistently meet the **existing** expired permit limits for cadmium and zinc. CH2M Hill should also evaluate whether there are some immediate operational changes that could be made to ensure compliance with the expired permit limits. For example, the current operating pH is between 8.5 and 9. Minimum solubility of zinc is at pH 9 and cadmium at pH 11. Raising the operating to pH to 9 to 9.5 should result in a reduction in zinc and cadmium in the discharge (most mine water treatment plants operate in the pH 9 - 10 range).

(2) Page 2, "Main Issues": A key element central to the evaluation of potential modifications to meet stricter discharge requirements, reduction in sludge volume, and equipment replacement is the estimated volume of water that will need to be treated. This is important in terms of both estimating feasibility of treatment options and predicting ability to comply with the TMDL wasteload allocations which will be expressed as loadings (mass/time). This is not addressed in this memo or the hydrology memo. Procedures for estimating the long-term volume of mine water requiring treatment needs to be included.

(3) Page 2, "Modification for Stricter Discharge Requirements": The last paragraph of page 1 states that the CTP may need to be upgraded depending upon the new discharge limits. I think that we should assume that the CTP **will** need to be upgraded or replaced, particularly since the CTP discharge does not consistently meet Clean Water Act (CWA) effluent guidelines that represent treatment via best available technology economically achievable (BAT) for mine drainage. The BAT effluent limitation guidelines for mine drainage are provided in 40 CFR 440.103(a).

The second paragraph of page 2 suggests an approach for evaluating what discharge limits could be expected for certain upgrades, in the absence of knowing what the specific limits might be. This is the approach that should be taken, since the time frame for completing the TMDL process is uncertain.

In several places this memo refers to the State as "setting limits". This terminology is inexact. The State is responsible for developing wasteload allocations (WLAs) for cadmium, lead, and zinc for the discharge through the TMDL process. However, in the State of Idaho, EPA is the responsible NPDES permitting agency and any "limits" would be set by EPA. Therefore, while it is appropriate to work with the State, the EPA Office of Water should also be involved in establishing treatment requirements and limits for the discharge.

Because the CTP is part of a Superfund site, an NPDES permit is not required for the discharge. However, the concentration of pollutants in the discharge should be limited consistent with what the CWA would require and consistent with what is required for other inactive mines in the Couer d'Alene basin. Specifically, the discharge should meet, at the minimum, BAT effluent limitations and the TMDL WLAs. For parameters without an established WLA (e.g., arsenic, copper, etc.) the allowable concentrations in the discharge should be based on State water quality standards. The water quality-based target discharge concentrations for these non-TMDL parameters may actually define the level of treatment required.

(4) Page 3, "Modifications to Reduce Sludge Volume", second paragraph: Contrary to the statement in the second sentence, changing from the current lime precipitation process may be cost effective if it will also accomplish the goal of meeting stricter discharge targets. In addition, there may be precipitants other than lime that produce sludges with more coherent properties, with or without operating in a HDS mode. For example, some reports claim that sludges produced from sulfide precipitation have better thickening and filtration characteristics, as compared to sludges produced via hydroxide precipitation.

(5) Page 3, Task 1: Discharge targets might be expanded to include parameters that are not currently monitored under the expired permit. Therefore, sampling may be required for these parameters as it is important to establish the baseline influent concentrations and baseline level of performance of the CTP for all parameters of concern in order to predict performance of potential upgrades.

(6) Page 4, Task 3: It is unclear why Task 3 is limited to evaluating iron coprecipitation. It would be more appropriate to initially look at a range of treatment options, perform comparative bench-scale treatability testing on the most promising options, and then perform a more detailed cost evaluation on the technologies that were successful in treatability testing. To accomplish

this I suggest merging Task 3 and the "Evaluate Best Available Treatment Technologies" portion of Task 6 into one task (or two subtasks). Then, Task 3 could be wholly focussed on evaluation of mine water treatment technologies and Task 6 could be wholly focussed on evaluation of sludge dewatering technologies.

The iron coprecipitation evaluation should not be limited to ferric chloride, but should also look at other iron salts, such as ferric sulfate and ferrous sulfate. I also suggest evaluating sulphide precipitation and the necessity for aeration combined with any of these processes.

(7) Page 4, Task 3, third bullet: It is highly likely that bench-scale treatability studies **will** be necessary to predict performance. Based on the bench-scale results, it can be determined whether continuous or pilot-scale testing is required.

(8) Page 5, Task 4: Adsorption processes (such as activated carbon adsorption) should be added to the list of potential secondary treatment steps included in the second sentence.

### **Attachment B Bunker Hill In-Mine Sludge Disposal Scoping**

(1) General Comment, Sludge Amendments: The evaluation of in-mine sludge disposal should also include evaluating the potential for adding amendments to the sludge prior to disposal to improve the physical or chemical characteristics for disposal (both in terms of stability and the potential to reduce future production of acid- and nonacid mine drainage).

(2) General Comment, "Introduction": The second sentence implies that only undewatered sludge will be evaluated for in-mine disposal. CH2M Hill should also consider evaluating in-mine disposal of dewatered sludge. It will be more expensive, but potentially advantageous in terms of reducing the amount of water introduced into the mine and stability.

(3) Page 1, "Feasible Disposal Locations" and page 3, Task 2: Areas for sludge disposal might also be prioritized based on the potential for AMD abatement.

(4) Page 3, Task 3, third bullet: The net neutralization potential of the sludge should be determined and compared to the acid generating potential of the rock (if known) in the disposal locations, otherwise sludge leachability tests should be performed. The evaluation of sludge characteristics task should also consider whether aging the sludge will produce beneficial characteristics for disposal (e.g., increase sludge stability).

### **Attachment C, Bunker Hill In-Mine Water Treatment**

General Comment: The discussion of in-mine water treatment seems to assume that: (1) the total volume requiring treatment will be similar to the current volume, and (2) the total volume will require **active** treatment. Given these constraints, I agree that in-mine treatment is not as effective as external treatment, and is not worth evaluating for all the reasons given in the memorandum. However, if flows can be reduced (e.g., via the surface water diversions, plugging, etc.), then **passive** in-mine treatment options should be evaluated for all or portions of the flow. Additionally, passive in-mine treatment should be evaluated as a potential first stage of treatment to reduce the strength of the AMD requiring further external treatment.

Passive treatment may be combined with plugging (e.g., amended hydraulic barriers) or as flow through systems (e.g., alkaline drains/trenches, permeable porous reactive walls). Passive treatment is probably only implementable directly before or after (in which case it is not really "in-mine") the mine water discharges from a portal or seep.

**From:** EARL LIVERMAN  
**To:** VOYTILLA-MARYKAY  
**Date:** 4/14/98 3:09pm  
**Subject:** Results of Scoping Session -Forwarded -Reply

Mary Kay - Please consider the following comments.

- An overall EPA strategy is not evident for the NBHM. For example, are we seeking to turnover the CTP within some given period, or "restore" the CTP for the benefit of the State and/or others, or ?
- I presume the desire for evaluating mineral reserves is to determine whether there is a potential relationship between generation of AMD and such reserves. If not, why are the reserves a concern?
- Evaluating the Sweeny Dump along with the Reed Dump.
- Engage the Northwest Mining Association to assist with identification/evaluation of in-mine treatment options.
- The timeframes for monitoring (e.g., 12 months for AMD areas, 9 months for inflow analysis) are likely unrealistic. Results of past efforts have been unpredictable--each water years appears different with respect to flow regimes.



IDAHO DEPARTMENT  
OF HEALTH AND WELFARE  
DIVISION OF  
ENVIRONMENTAL QUALITY

1005 West McKinley, Kellogg, ID 83837-2513, (208) 783-5781

Philip E. Batt, Governor

April 21, 1998

MEMORANDUM

To: Mary Kay Voytilla, EPA

From: Nick Zilka, IDEQ

*Nick*

Subject: Mine water treatment

As I have stated on our Bunker Hill mine water conference calls, I believe we should attempt to determine if a treatment technology exists that will produce both clean water and a marketable sludge. In other words, our goal would be to comply with future TMDL standards and avoid construction of major sludge disposal facilities. To that end, I have done some preliminary research, which is summarized below.

**KEECO Process** - tested twice at Bunker Hill with some success. Claimed to produce 1/4 the volume of sludge and a marketable sludge with 34% zinc. Contacts: Mr. Andrews, KEECO, 206-778-7165; Mr. Svec, MT Tech, 406-782-5263.

**Russ Forba, EPA, Helena, MT** - believes lowest cost and least complex method to achieve clean water is conventional lime treatment. He has come to this conclusion after observing several demo projects at the Berkeley Pit. Sludge disposal is not an issue because an active tailings pond is available.

**Green Precipitate Process** - tested at Berkeley Pit with some success. Contacts: Geo2 Limited, Australia, 61-3-9600-1319; Mr. Anderson, MT Tech, 406-496-4409.

**Applied Research** - tested at Bunker Hill CTP. Claimed to produce a saleable zinc and manganese product and a detoxified sludge. Contact: Dr. Pesic, U of Idaho, 208-882-8651.

**Liquid Emulsion Membrane** - tested at Bunker Hill by U.S. Bureau of Mines with some success. Research is continuing at U.S. DOE, Albany, OR. Contact: Mr. Nilson, 503-967-5892.

**Tetra Technology Process** - tested at Berkeley Pit. Said by MSE, Inc. (A government-funded research firm) to be the most promising of any they have studied. Contact: Dr. Foote, MSE, 406-494-7431.